Marine Environmental Data Service

Temperature, Salinity and Sigma-t at Station 27 (47°33'N, 52°35'W) An Analysis of Historical Data

J.R. Keeley

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J.R. Keeley

DEPARTMENT OF FISHERIES AND OCEANS
OTTAWA, CANADA

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(Appendix B is only on microfiche)

The scales on the σ_t axes of the figures in Appendix B are inverted. In all cases, the value of 27.2 should be closest to the bottom of the figure.

The scale for the plot of mean σ_t in Appendix D should have a range from 23 to 29 in increments of 1.5.

Ottawa

1981

ABSTRACT

This report is an extension of a report of 10 years of data from Station 27. Here, 32 years of temperature and salinity data have been treated. Results show contours of temperature, salinity and σ_t over depth and time for each year, and for the 32 year averages. The data set was filtered to show the interannual variation in the three parameters over the record length. Finally, anomalies of the three parameters were calculated and displayed at selected depths.

RÉSUMÉ

Le présent rapport complémente un autre rapport qui portait sur 10 années de données recueillies à la station 27; celui-ci porte sur 32 années. Les températures et les salinités ont été traitées puis converties en courbes montrant la variation de ces paramètres et de σ_t selon la profondeur et au cours de chaque année, ainsi que leur moyenne sur 32 ans. Le filtrage de l'ensemble de données a permis d'en montrer les variations d'une année à l'autre de la période. Enfin les anomalies ont été calculées et elles sont montrées pour certaines profondeurs.

This report is dedicated to Mr. A. G. Kelland for his many years of service in compiling these data.

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INTRODUCTION

A few years ago, a report similar to this one was prepared by A. Huyer and A. Verney (1975). That report presented the analyses of temperature, salinity and σ_t observed at Station 27 from 1950 to 1959. The report did not exhaust all of the data for Station 27 held by MEDS. With the recent interest in determining long period fluctuations in oceanographic conditions, it was decided to extend the work of Huyer and Verney to include as much of the data which exists from Station 27 as possible. The result is this report, showing the temperature, salinity and σ_t conditions from 1946 to 1977. Because of the long data set, it was possible to determine the mean seasonal cycle in these parameters. It then became possible to examine the data over the years to identify anomalous conditions. A simple analysis to this end is included in this report.

The volume of data to be presented necessitated the use of a computer as much as possible. All of the data analyses and all of the figures in this report were computer generated. In particular, the figures of temperature, salinity and σ_t over time and depth were produced using the technique of optimum interpolation to prepare the data for contouring by computer. A brief description of this technique will be given but readers who wish detailed information should consult the appropriate references cited. The application of the technique was accomplished using software developed at MEDS. Those readers requiring more information about this aspect should read Taylor (1980).

THE DATA

The first task was to identify all of the existing data for Station 27 held at MEDS. The data are contained in the Nansen bottle file and are observations usually taken at standard depths using water sampling bottles. For ease of retrieval, Station 27 was defined to be the 1° square centred on 47.5°N, 52.5°W (Figure 1). All observations within this area were treated as being taken at the published location of Station 27. In total, there were 830 stations with a temporal distribution shown in Table 1. It was decided that observations in at least 6 months were necessary before the data from a year could be successfully treated. From Table 1, it is clear that the years meeting this condition were 1934, 1935 and 1946 to 1977. The data after 1977 had not yet been updated into MEDS files when this report was being prepared. All of the data from the above mentioned years were screened to remove those data falling outside of coarse range checks. The range for temperature was -2° to 25°C, for salinity 25% to 35% and for σ_t 22.0 to 28.0. Only 8 data failed this test and these were deleted from the file. These data are listed in Table 2.

There was no manual scrutiny of the data to ensure that they were correct. There were two reasons for this. Firstly, from experience using these data for other purposes, it was known that they were generally of high quality. Secondly, the analysis scheme had built into it an ability to assess data quality and to limit the effects of erroneous data on the products to be generated.

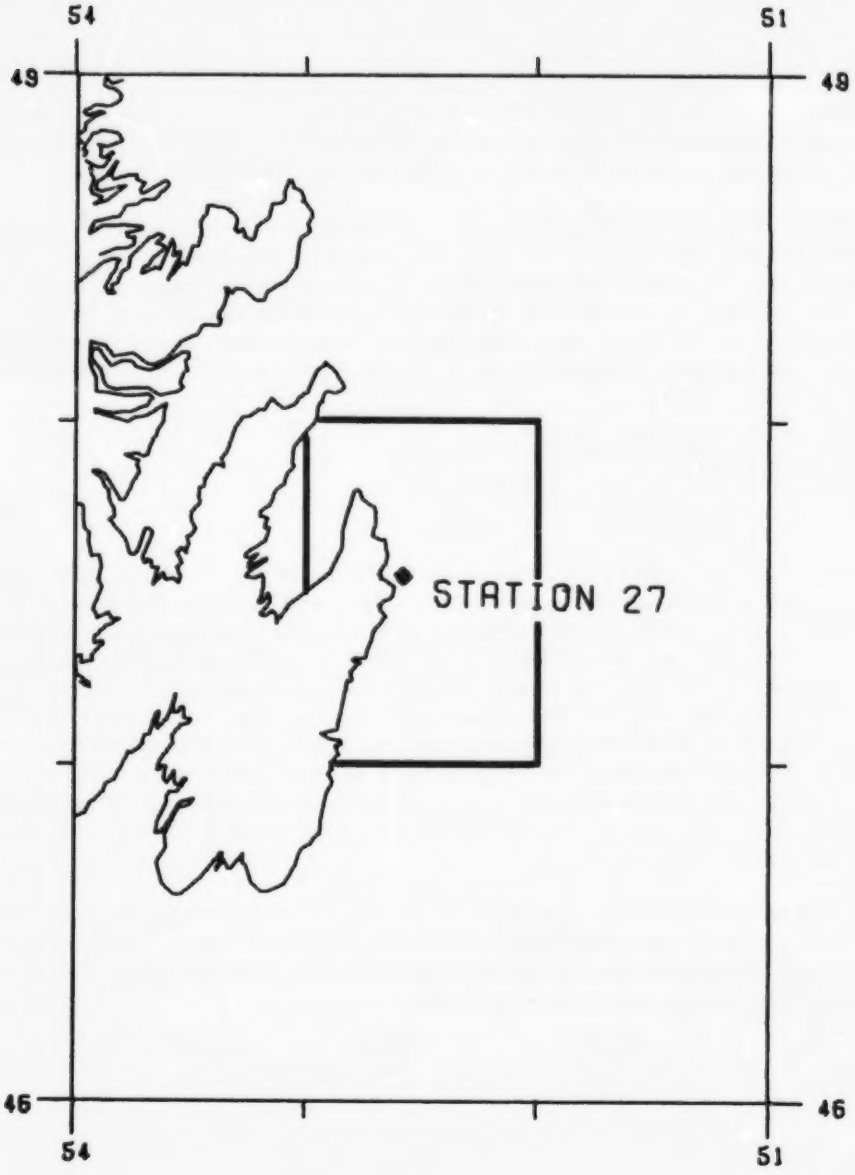

Figure 1. Location map of Station 27.

Table 1 - Count of stations sampled in a particular year and month for the 1° square centred on 47°30'N, 52°30'W

YEAR	MONTH												TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	
1910							1						1
28									2				2
31						1	2		1	1			5
32					2				1				3
33						5	1	1	3				10
34					1	2	2	1	3	3			12
35		1	1		1	1	5	1	2	1			13
46						1	2	2	3	2	3	1	14
47			2		1	1	2		1	2	1		10
48			2	1	1	1	1	3					9
49						1	1	2	3	2		1	10
50	1	1	1	3		3	2	1	2		1	1	16
51	1	1	2	2	5	2	3	2	1	1			20
52	1			7	2	3	5	5	1	2		1	27
53		1		5	2	3	5	7	1	2	2	1	29
54	1	2	2	5	3	2	5	4	1	2	1	1	29
55	1	1		2	2	2	4	6	2	5	2	1	28
56	1	1	2	1	1	3	5	6	1	2	1	1	25
57	1	1	1	2	1	2	6	4	1	1	2	2	24
58	1	1	7	2	2	3	5	4	1	3	5	1	35
59	1	1	3	2	1	4	5	8	1	3	4	1	34
60	1	1	1	1	3	3	4	3	3	2	1	1	24
61	2	2	3		1	2	7	5	11	1	3		37
62	1	1	1	1	3	3	3	3	1	4	2	1	24
63	2	1	1	3	1	3	3	2	2	3	2	2	25
64	1	1	1	4	3	2	4	4	3	2	3	1	29
65	2	3	2	1	3	3	4	4	1	2	3	1	29
66	1	1	3	3	3	2	3	2	2	2	1	2	25
67	2	2	2	1	3	2	2	3	2	2	2	2	25
68	3	4	3	3	4	3	4	3	3	2	3	1	36
69	1	2	4	1	4	2	3	2	1	5	2	1	28
70	1	3	3	3	3	3	3	3		2	3	1	28
71	1	2	2	2	3	3	2	3	1	1	1	2	23
72	1	2	3	2	2	1	4	3	1	2	2		23
73	1	2	2	2	2	3	3	2	2	2	2	1	24
74	1	1	2	2	2	5	1	4	1	3	2		24
75	2	1		2	1	2	3	1	1	3	2	1	19
76	1	2	1	2	4	2	3	1	2	2	1	1	22
77	2	3	1	3	3	3	2	1	2	3	2	2	27

Table 2 – Data failing rough range checks

DAY	MONTH	YEAR	DEPTH	PARAMETER
3	3	48	50	Salinity (36.77)
3	3	48	75	Salinity (35.97)
3	3	48	100	Salinity (36.59)
25	1	50	100	Salinity (37.75)
25	1	50	150	Salinity (35.40)
15	8	52	0	Sigma-t (21.78)
26	8	52	0	Sigma-t (21.69)
18	4	56	170	Sigma-t (28.07)

DATA ANALYSIS

The bulk of the required analysis was to produce figures of the time and depth distribution of temperature, salinity and σ_t. In the Huyer, Verney report this information was displayed for each year with the vertical axis being depth and the horizontal axis being time. The data were then annotated on the axis and hand contoured. That type of display is duplicated in this report but because of the volume of data, and to ensure consistency, it was decided to use an automated routine to contour the observations.

In order for data to be contoured by computer it is first necessary to grid the available data and to fill in any gaps which may exist. The scheme chosen to do this is called Optimum Interpolation (hereafter called OI) and was first developed by Russian meteorologists (Gandin, 1965). The technique was used by those planning the MODE experiment (Bretherton et. al., 1976) and extended to other oceanographic problems by Davis (1976). The capability at MEDS to use this technique became available recently. OI is an analysis based on the Gauss-Markov theorem and, for the parameter under consideration, yields at every point in the field the best estimate in a least squares sense. Its application requires knowing the covariance function, or structure function (which is related (Bretherton et. al.)) of the data and an estimate of the noise. The determination of these can be made from the data.

There was no reason to believe that a structure function generated from the observations over depth and time should have the same scaling. In fact, they do not - as was found by testing the data. The calculation of the structure function for data separated only vertically and then only horizontally showed two different scales for the data from 1960 to 1969. The ratio of scales showed some variation depending on the parameter (Table 3) but was about one month being equivalent to 10 meters in depth. The appropriate ratios for each parameter were used to scale the data and then an average nonscaled structure function was computed for the years 1946 to 1977. These averages were then fitted by a curve and fitted structure function used in the OI program. Figure 2 shows the average and fitted structure functions for temperature, salinity and σ_t.

Table 3a - Lengths at which the structure function of the temperature falls below -1. The horizontal scale is months and the vertical scale is meters. Values in brackets were alternatively chosen where the structure function was not so stable that one scale could be easily chosen.

YEAR	HORIZONTAL	VERTICAL
1960	4.57	39.0 (58.5)
61	4.59	41.4 (60.0)
62	5.06	51.0 (63.0)
63	4.32	57.0 (68.1)
64	4.06	75.0
65	4.45	57.0
66	4.21	78.0
67	4.39	81.0
68	4.45	78.0
69	4.59	51.0
MEAN	**4.47**	**60.8 (67.0)**

Ratio vertical to horizontal is 1/14.9

Table 3b - Lengths at which the structure function of the salinity falls below -0.5. The horizontal scale is months and the vertical scale is meters.

YEAR	HORIZONTAL	VERTICAL
1960	4.32	42.0
61	5.40	39.0
62	4.94	41.7
63	3.51	48.0
64	2.86	48.0
65	6.01	45.0
66	5.26	55.5
67	6.01	46.5
68	4.63	55.5
69	5.55	51.0
MEAN	**4.84**	**42.3**

Ratio vertical to horizontal = 8.74

Table 3c - Length at which the structure function of σ_t falls below -1.0. The horizontal scale is months and the vertical scale is meters.

YEAR	HORIZONTAL	VERTICAL
1960	6.21	68.7
61	5.91	54.0
62	8.45	68.1
63	5.40	68.1
64	4.62	78.0
65	6.14	67.5
66	5.41	81.6
67	5.02	79.5
68	5.34	83.4
69	6.21	69.0
MEAN	**5.87**	**71.79**

Ratio vertical to horizontal = 12.23

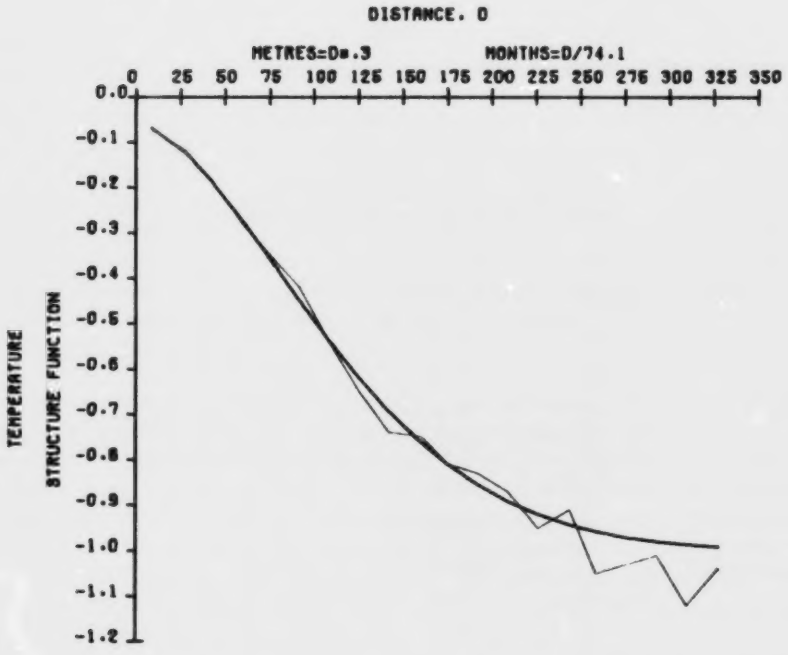

Figure 2a. The nonscaled temperature structure function. The light line is the average and the heavy line is the fitted function.

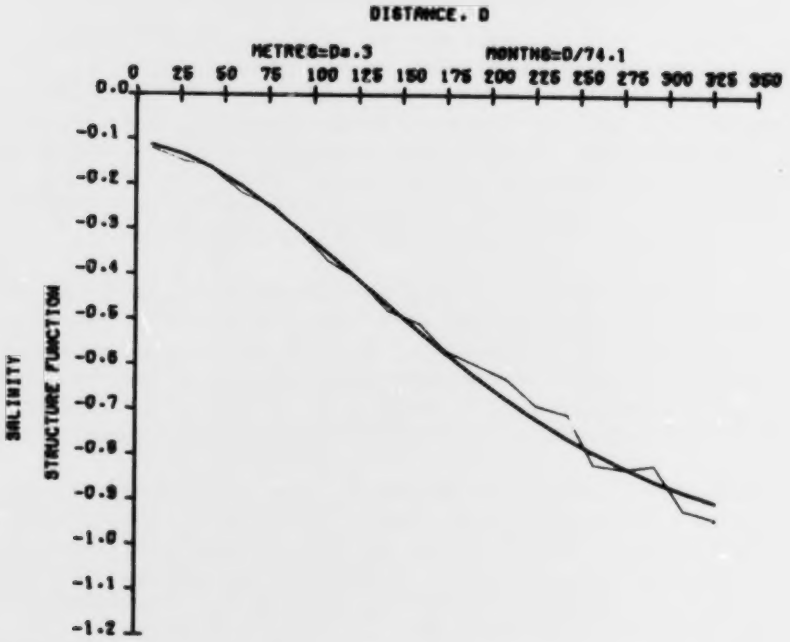

Figure 2b. The nonscaled salinity structure function. The light line is the average and the heavy line is the fitted function.

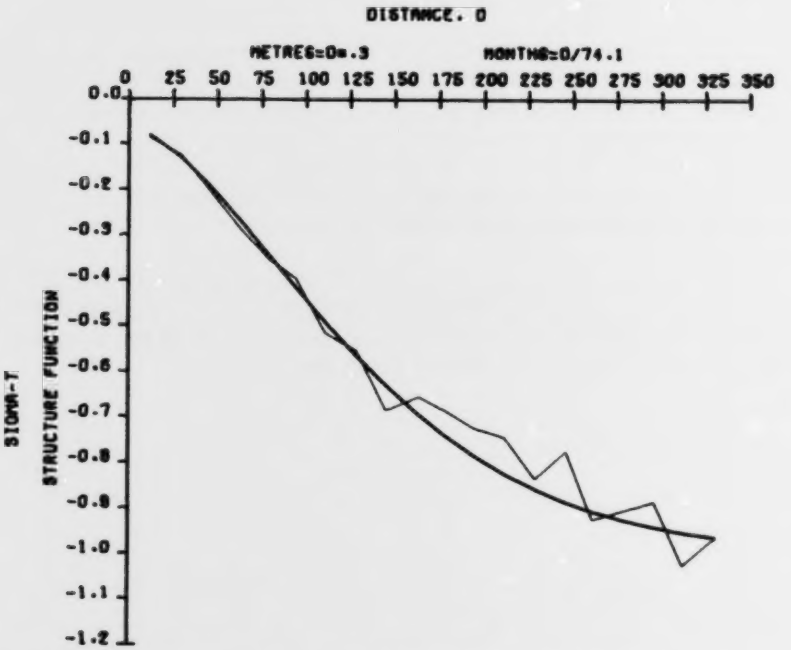

Figure 2c. The nonscaled σ_t structure function. The light line is the average and the heavy line is the fitted function.

The next step was to determine the amount of noise in the data. At this point it is worthwhile to reflect upon just what constitutes noise in this calculation. Usually, noise in a data set is considered to be related to the amount of variation measured by two sets of observations taken as close together in space and time as possible. For the data used, there were very few of these; consequently, most of the noise estimated here is due to the sampling. Observations were taken about two or three weeks apart and the degree of correlation between these observations is what is reflected in the structure function. The noise is estimated by extrapolating the structure function back to zero separation. The correlation between stations is affected by storms or periods of sunny weather or any number of factors which can mask the seasonal trend.

An advantage of OI is not only do you get best estimates of the parameter but also an error map can be calculated. The error map reflects the uncertainties found in the interpolations and allows some judgements of the data quality to be made. It is possible to use OI to give an estimate of the value to be expected at a data point, then the ratio of the actual to expected value can be computed for each observation. When this ratio exceeds the value of 3, the quality of the data becomes questionable. Tables 4a - 4c are compilations of all of the data for which the ratio exceeded 3. These data have been used in the analysis but their effect is small.

The set of figures (Appendix A, on microfiche) are the contoured fields of temperature, salinity and σ_t over depth and month for each of the years, 1934, 1935 and 1946 to 1977. The plus signs indicate where and when observations were made but the figures have not been annotated by the data in order to maintain a neat appearance. Only three contours in the error map (dashed lines) are shown and these are simply to aid in the interpretation of the contours of the parameter. Contours have been blanked out where the errors exceeded the value of the largest error contoured.

Because of the long continuous data series (from 1946 to 1977), it was possible to separate the longer period fluctuations in the data from the seasonal cycle. This was done by using the data interpolated on to a 10 meter by half monthly grid. At each depth the observations over the 32 years were passed to a filtering program. The filter was a Cartwright filter with zero response for fluctuations shorter than one year and 100% response for fluctuations longer than two years. The results are displayed at standard depths for each parameter in Appendix B (on microfiche). The heavy line is the low passed signal, while the light line is the gridded data.

The high pass portion was examined and averaged over all the years to generate the seasonal cycle for each parameter. The gridded data and the contoured results are included in Appendix C. These figures represent the average conditions to be found for each parameter over the 32 year period. They represent a baseline condition to which data may be compared.

Some of the data in Appendix C are displayed again in Appendix D. Here, the average temperature, salinity and σ_t at selected depths are shown as they vary over a year.

The final figures (Appendix E) show the computed anomaly of temperature, salinity and σ_t at selected depths. The anomaly has been calculated by subtracting the 1946-1977 average from the gridded data. Gaps in the records indicate data gaps. It should also be noted that the values of the anomalies near the gaps may be unreliable because of the nature of the gridding of the data.

ERRATA The labelling of the error contours in Appendix A are difficult to read. For temperature they are 1.5, 2.0, and 2.5; for salinity they are .15, .18, and .21; and for sigma-t they are .25, .30, and .35.

Table 4a – Data for which MR/ER >3 for temperature

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1934	23	8	25	2.8	3.02	63
	23	8	100	3.1	3.45	
	20	10	50	5.3	4.15	
	21	10	50	-0.8	4.43	
1935	7	7	25	9.0	4.93	73
	8	7	20	2.5	3.46	
	8	7	30	0.0	5.39	
	23	8	25	8.0	3.96	
	6	9	25	0.8	3.86	
1946	4	8	25	11.1	4.04	71
	17	8	25	4.6	4.13	
	21	11	0	0.5	3.08	
1947	28	7	50	6.7	3.07	88
	5	10	50	-0.2	4.02	
	17	10	50	7.5	4.56	
1948			NONE			69
1949	20	9	25	11.77	3.15	82
1950	25	1	0	-0.53	3.68	132
	25	1	25	-0.5	3.24	
	25	1	50	-0.55	3.11	
	3	2	0	5.35	4.44	
	3	2	25	4.55	3.68	
	3	2	50	4.43	3.71	
	3	2	75	3.6	3.18	
1951	1	6	25	-0.08	3.12	152
	20	7	25	9.52	6.09	
	8	8	25	-0.1	4.17	
	15	9	50	11.01	5.01	
	23	10	50	2.06	3.06	
1952	28	8	25	1.82	4.25	177
	15	9	25	11.16	3.45	
	15	9	50	7.62	5.07	
	6	10	50	0.65	4.42	
1953	11	8	50	6.9	5.78	214
	15	8	25	4.31	3.41	
	15	8	25	4.31	3.41	
	18	8	25	10.36	3.33	
	18	8	25	10.36	3.33	
	20	10	50	7.09	3.13	
1954	24	7	25	6.32	3.35	226
	24	7	25	6.32	3.35	

Table 4a (Continued)

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1955	20	7	25	7.74	3.17	223
	20	7	25	7.74	3.17	
	20	7	25	2.36	3.15	
	20	7	25	2.36	3.15	
	8	10	74	7.55	6.95	
	12	10	50	-0.19	4.21	
	12	10	75	-1.33	3.33	
1956			NONE			205
1957	20	8	0	14.94	3.20	192
	20	8	0	14.94	3.20	
1958	31	10	50	0.04	3.84	292
	31	10	75	-1.34	3.90	
1959	20	8	20	11.91	5.31	347
	20	8	20	11.91	5.31	
	20	8	20	2.43	5.48	
	20	8	20	2.43	5.48	
	9	9	30	12.04	4.81	
	12	11	75	3.78	3.39	
	12	11	100	3.11	3.58	
1960	22	7	0	8.2	3.36	291
	22	7	20	3.46	3.45	
	23	7	20	10.65	5.01	
	16	8	20	3.56	4.17	
	16	8	20	1.47	6.63	
	16	8	30	-0.63	3.46	
	19	8	20	14.1	8.22	
	19	8	30	5.0	3.23	
1961	19	6	20	-1.1	4.13	333
	23	8	20	3.83	5.65	
	3	9	0	9.26	3.37	
	6	9	30	12.06	4.24	
	29	9	30	5.19	3.93	
	29	9	40	0.58	4.38	
1962	24	7	20	9.29	4.72	268
	6	9	30	9.86	3.67	
	4	12	50	-0.84	3.94	
1963	28	7	30	0.9	3.45	267
1964	23	7	30	5.33	3.03	355
	23	7	20	10.15	3.65	
	18	8	30	3.29	3.13	
	30	8	30	8.93	3.51	
	23	9	50	7.05	3.88	
	30	9	50	0.95	3.96	
1965			NONE			328

Table 4a – (Continued)

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1966	19	7	20	3.97	3.04	319
	26	7	20	11.09	5.34	
	5	8	10	5.75	4.21	
	5	8	20	1.84	3.18	
	4	10	50	7.58	3.92	
1967	9	10	50	10.95	3.98	339
1968	10	10	75	0.84	3.34	387
	18	10	75	7.17	4.90	
	5	11	75	-0.01	3.92	
	12	11	75	5.36	3.04	
1969	18	8	30	2.07	3.49	315
1970	27	7	30	8.81	5.43	333
	27	7	30	0.54	5.09	
	17	8	20	5.73	3.99	
	17	8	30	0.47	3.78	
	17	8	30	0.34	3.94	
	28	8	0	10.8	3.46	
	28	8	30	7.76	5.02	
1971	29	7	30	0.41	3.15	296
	18	8	20	14.53	3.40	
	18	8	30	3.2	3.36	
1972	21	7	30	5.99	3.75	277
	26	7	20	4.99	3.31	
	26	7	30	-0.01	3.33	
	19	8	20	12.77	3.58	
	19	8	30	0.07	3.76	
1973			NONE			274
1974	22	10	50	0.39	3.12	308
	30	10	50	5.39	3.43	
1975	22	7	10	11.99	3.22	238
	22	7	10	6.86	3.08	
	14	9	20	3.86	3.11	
	1	10	20	11.03	3.73	
1976			NONE			297
1977	19	6	30	6.49	5.05	292
	29	6	20	1.29	3.74	
	29	6	30	-1.12	4.59	
	26	9	50	7.46	4.00	
	24	10	50	6.23	3.58	
	25	10	50	-1.22	5.81	

Table 4b – Data for which MR/ER >3 for salinity

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1934	18	7	10	30.97	3.42	57
	23	8	100	32.19	4.04	
1935	9	7	0	32.64	3.44	70
	29	7	0	30.86	3.13	
	23	8	0	30.21	3.78	
	23	8	10	30.42	3.82	
	23	8	25	31.06	4.23	
	6	9	25	32.52	3.98	
1946	10	10	50	31.15	3.06	71
1947	5	10	75	31.33	3.15	81
	5	10	150	31.38	6.34	
1948	13	7	0	31.69	3.37	59
1949	15	12	172	32.33	3.53	65
1950	25	1	25	33.14	3.89	128
	25	1	50	33.53	4.83	
	25	1	75	34.55	8.93	
	3	2	25	31.68	3.88	
	3	2	50	31.73	4.86	
	3	2	75	31.87	5.34	
	3	2	150	31.88	4.34	
	10	4	0	31.53	4.34	
	23	7	0	31.04	3.04	
	30	9	50	31.11	4.93	
1951	20	7	50	33.41	4.30	151
	20	7	50	32.12	4.31	
	15	9	50	31.46	3.94	
1952	28	6	100	32.18	4.64	173
	26	7	0	32.04	3.78	
	26	7	0	32.04	3.78	
	12	8	0	31.83	4.70	
	12	8	25	32.63	3.29	
	15	8	0	29.92	4.71	
	26	8	0	29.82	4.20	
	15	9	25	30.65	3.74	
	27	10	45	30.93	3.79	
1953	17	6	100	32.10	4.17	216
	1	9	99	32.18	3.37	
1954			NONE			225
1955	24	1	150	32.31	3.30	224
	16	5	0	32.77	3.38	
	20	7	25	32.77	3.10	
	20	7	25	32.77	3.10	
	15	8	25	32.50	3.08	

Table 4b – (Continued)

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1955	15	8	25	32.50	3.08	
	9	9	25	30.96	3.59	
	12	10	100	31.93	4.74	
	12	10	150	32.39	3.61	
	12	10	30	32.3	3.09	
	12	10	50	33.08	4.48	
1956	18	4	150	34.79	7.32	200
	18	4	170	34.89	7.22	
	11	5	149	32.65	3.33	
	30	10	72	31.58	3.33	
1957	6	6	47	31.76	3.34	190
	30	7	0	32.18	4.14	
	30	7	25	32.94	3.70	
	4	10	25	30.86	3.49	
1958	18	11	0	30.64	3.88	284
1959	8	8	20	32.74	3.91	340
	9	9	30	31.08	3.10	
	12	11	75	31.47	3.64	
	12	11	100	31.56	4.88	
1960	16	8	20	32.32	3.59	287
	19	8	20	30.79	3.91	
	9	9	30	30.77	4.30	
1961	9	1	100	33.57	4.69	333
	9	1	150	33.92	4.99	
	18	5	0	31.01	3.26	
	18	5	10	31.00	3.30	
	18	5	20	31.04	4.10	
	1	9	180	31.38	7.10	
1962	22	11	0	30.72	3.32	254
	4	12	50	32.84	4.21	
1963	18	10	50	31.14	3.22	264
1964	12	1	100	31.80	3.40	346
	12	1	150	31.80	4.52	
	12	1	172	31.80	4.76	
	14	7	125	32.22	3.95	
	14	7	150	32.22	4.13	
	14	7	168	32.28	4.18	
	17	8	0	31.207	3.20	
	18	8	0	32.295	3.63	
	18	8	10	32.244	3.19	
	18	8	30	32.814	3.77	
	8	9	30	31.17	3.06	
	23	9	50	31.65	3.08	
	9	11	100	32.09	3.02	

Table 4b – (Continued)

YEAR	DAY	MONTH	DEPTH	OBS	MR/ER	NO. POINTS
1965			NONE			317
	26	7	135	32.82	3.16	309
1967	12	5	0	31.12	3.92	329
	9	10	50	31.42	3.08	
1968	18	10	75	31.15	4.86	375
1969	20	10	75	31.47	3.95	301
1970	17	8	30	32.25	3.74	321
	15	10	50	30.70	3.17	
1971			NONE			296
1972	6	8	0	30.73	3.42	277
	6	8	10	30.64	3.89	
	6	8	20	30.73	4.34	
	6	8	30	31.24	3.72	
	19	8	30	32.61	3.96	
	12	10	75	31.89	3.37	
	12	10	100	32.05	3.23	
1973	18	5	10	30.88	3.23	272
1974	16	6	3.8	32.71	3.72	305
	16	6	5.7	32.67	3.52	
	16	6	11.4	32.81	3.72	
	27	6	0	31.24	3.38	
	27	6	10	31.24	3.86	
	27	6	20	31.24	4.18	
	27	6	30	31.67	3.45	
	5	7	30	31.55	3.89	
	9	8	20	32.57	4.84	
	9	8	30	32.81	3.52	
	20	8	30	32.05	3.70	
	20	8	20	32.38	4.94	
	23	9	50	32.28	3.40	
	2	10	20	29.88	3.25	
	2	10	30	30.30	3.14	
	2	10	50	30.42	6.10	
	22	10	50	30.57	3.39	
1975	22	7	0	32.35	3.18	204
	22	7	10	32.52	3.12	
	14	9	50	32.94	3.04	
1976	6	10	50	31.17	3.33	284
1977	28	7	0	32.16	3.66	285
	9	9	30	32.16	4.09	
	26	9	50	30.64	5.77	
	26	9	75	30.73	7.56	
	25	10	50	32.70	4.87	

Table 4c – Data for which MR/ER >3 for σ_t

YEAR	DAY	MONTH	DEPTH	OBS			MR/ER	NO. POINTS
1934	23	8	100	3.1	32.19	25.66	3.52	57
1935	7	7	25	9.0	32.07	24.85	3.83	70
	8	7	30	0.0	32.77	26.33	3.06	
	29	7	0	13.68	30.86	23.08	3.46	
	23	8	25	8.0	31.06	24.21	4.61	
	6	9	25	0.8	32.52	26.09	4.23	
1946	10	10	50	9.4	31.15	24.07	3.47	70
1947	5	10	150	-0.6	31.38	25.23	3.82	81
1948			NONE					59
1949	20	9	25	11.77	31.04	23.58	3.63	65
1950	25	1	25	-0.5	33.14	26.65	4.21	128
	25	1	50	-0.55	33.53	26.97	4.88	
	25	1	75	-0.72	34.55	27.80	7.20	
	3	2	25	4.55	31.68	25.12	4.14	
	3	2	50	4.43	31.73	25.17	5.12	
	3	2	75	3.60	31.87	25.36	6.08	
	10	4	0	-0.42	31.53	25.35	3.55	
1951	1	6	25	-0.08	32.27	25.93	3.01	151
	20	7	25	9.52	31.87	24.61	3.63	
	15	9	50	11.01	31.46	24.04	4.69	
1952	24	7	0	15.4	31.06	22.88	3.80	170
	12	8	0	15.3	30.14	22.19	3.79	
	15	9	25	11.16	30.65	23.39	3.76	
	15	9	50	7.62	31.78	24.82	3.46	
	6	10	50	0.65	32.41	26.01	3.82	
1953	11	8	50	6.9	32.25	25.29	3.45	212
1954			NONE					225
1955	20	7	25	2.36	32.77	26.18	3.29	223
	20	7	25	2.36	32.77	26.18	3.29	
	9	9	25	11.48	30.96	23.57	3.71	
	8	10	74	7.55	32.30	25.24	4.07	
	12	10	100	1.26	31.93	25.59	3.84	
	12	10	30	3.96	32.30	25.67	3.57	
	12	10	50	-0.19	33.08	26.59	4.61	
	12	10	75	-1.33	33.24	26.76	3.06	
1956	18	4	150	-0.6	34.79	27.99	4.68	199
1957	30	7	0	9.07	32.18	24.92	4.36	190
1958	31	10	50	0.04	32.43	26.05	3.20	283
	18	11	0	4.70	30.64	24.28	3.06	

Table 4c – (Continued)

YEAR	DAY	MONTH	DEPTH	OBS			MR/ER	NO. POINTS
1959	20	8	20	11.91	31.33	23.78	4.29	340
	20	8	20	11.91	31.33	23.78	4.29	
	20	8	20	2.43	32.12	25.66	4.38	
	20	8	20	2.43	32.12	25.66	4.38	
	9	9	30	12.04	31.08	23.57	4.24	
	12	11	75	3.78	31.47	25.03	3.72	
	12	11	100	3.11	31.56	25.16	4.54	
1960	23	7	20	10.65	31.91	24.46	3.27	284
	16	8	10	9.44	31.69	24.48	3.21	
	16	8	20	3.56	32.0	25.47	4.11	
	16	8	20	1.47	32.32	25.89	6.11	
	19	8	10	14.20	30.75	22.89	4.36	
	19	8	20	14.10	30.79	22.94	7.94	
	9	9	30	9.0	30.77	23.83	3.73	
1961	9	1	150	-0.48	33.92	27.28	3.03	330
	23	8	20	3.83	31.82	25.30	3.18	
	1	9	180	-1.07	31.38	25.25	4.50	
	6	9	30	12.06	31.38	23.79	3.80	
	29	9	30	5.19	32.02	25.32	3.82	
	29	9	40	0.58	32.44	26.04	3.59	
1962	4	12	50	-0.84	32.84	26.42	4.09	254
1963			NONE					264
1964	18	8	30	3.29	32.814	26.14	4.60	346
	30	8	30	8.93	31.56	24.46	3.40	
	23	9	50	7.05	31.65	24.80	3.66	
	30	9	50	0.95	32.56	26.11	3.05	
1965			NONE					316
1966	26	7	20	11.09	32.21	24.61	3.20	309
	5	8	10	5.75	32.12	25.33	3.41	
	4	10	50	7.58	31.65	24.73	3.20	
1967	9	10	50	10.95	31.42	24.02	4.24	328
1968	18	10	75	7.17	31.15	24.39	5.11	375
	5	11	75	-0.01	32.63	26.22	3.64	
1969	20	10	75	5.71	31.47	24.82	3.41	301
1970	27	7	30	8.81	31.60	24.51	3.54	321
	27	7	30	0.54	32.3	25.93	3.67	
	17	8	0	15.5	30.26	22.24	3.62	
	17	8	30	0.34	32.25	25.90	4.20	
	28	8	30	7.76	30.99	24.19	4.14	
1971	18	8	30	3.20	32.01	25.51	3.27	296

Table 4c – (Continued)

YEAR	DAY	MONTH	DEPTH		OBS		MR/ER	NO. POINTS
1972	26	7	20	4.99	32.32	25.58	3.26	277
	6	8	20	10.74	30.73	23.52	3.72	
	19	8	30	0.07	32.61	26.20	4.39	
1973			NONE					272
1974	27	6	0	4.40	31.24	24.78	3.18	305
	27	6	10	4.22	31.24	24.80	3.46	
	27	6	20	3.85	31.24	24.84	3.94	
	5	7	30	5.51	31.55	24.91	3.40	
	9	8	20	3.91	32.57	25.89	3.04	
	20	8	20	3.62	32.38	25.76	3.86	
	23	9	50	-0.30	32.28	25.95	3.95	
	2	10	50	-0.13	30.42	24.44	4.04	
1975	22	7	0	13.1	31.43	23.63	3.52	204
	22	7	10	11.99	31.65	24.02	3.36	
	22	7	0	9.1	32.35	25.05	3.68	
	22	7	10	6.86	32.52	25.51	4.03	
	1	10	20	11.03	30.93	23.63	3.02	
1976			NONE					284
1977	19	6	30	6.49	31.82	25.01	3.61	284
	26	9	50	7.46	30.64	23.95	5.46	
	26	9	75	1.86	30.73	24.59	5.50	
	4	10	75	-0.71	32.63	26.25	3.10	
	25	10	50	-1.22	32.70	26.32	5.32	

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APPENDIX A

The temperature (°C), salinity (‰) and σ_t distributions over depth and time for 1934, 1935 and 1946 to 1977.

(on microfiche)

APPENDIX B

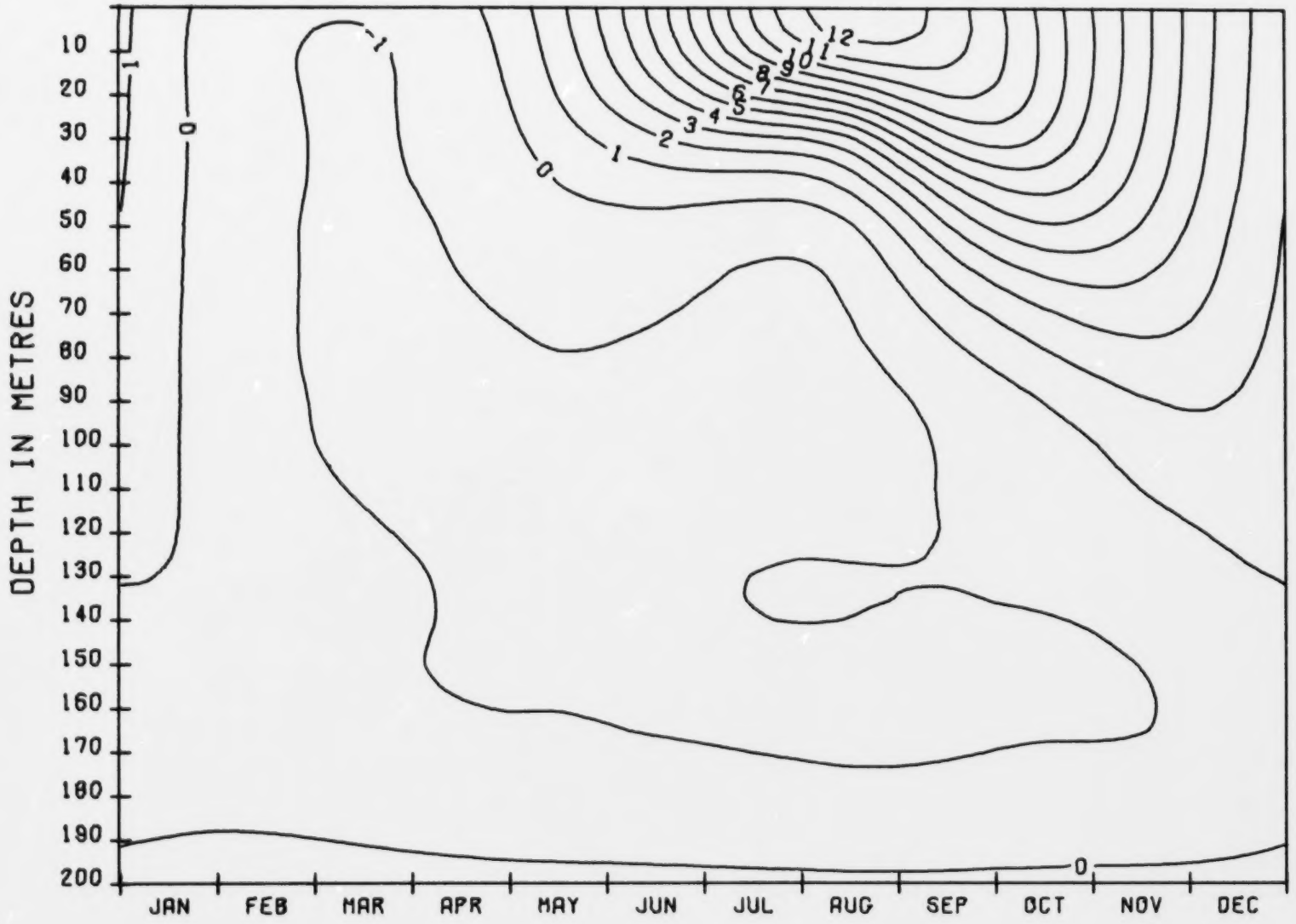
The filtered temperature, salinity and σ_t data shown at selected depths. The light line is the gridded data and the heavy line is the low pass filtered output.

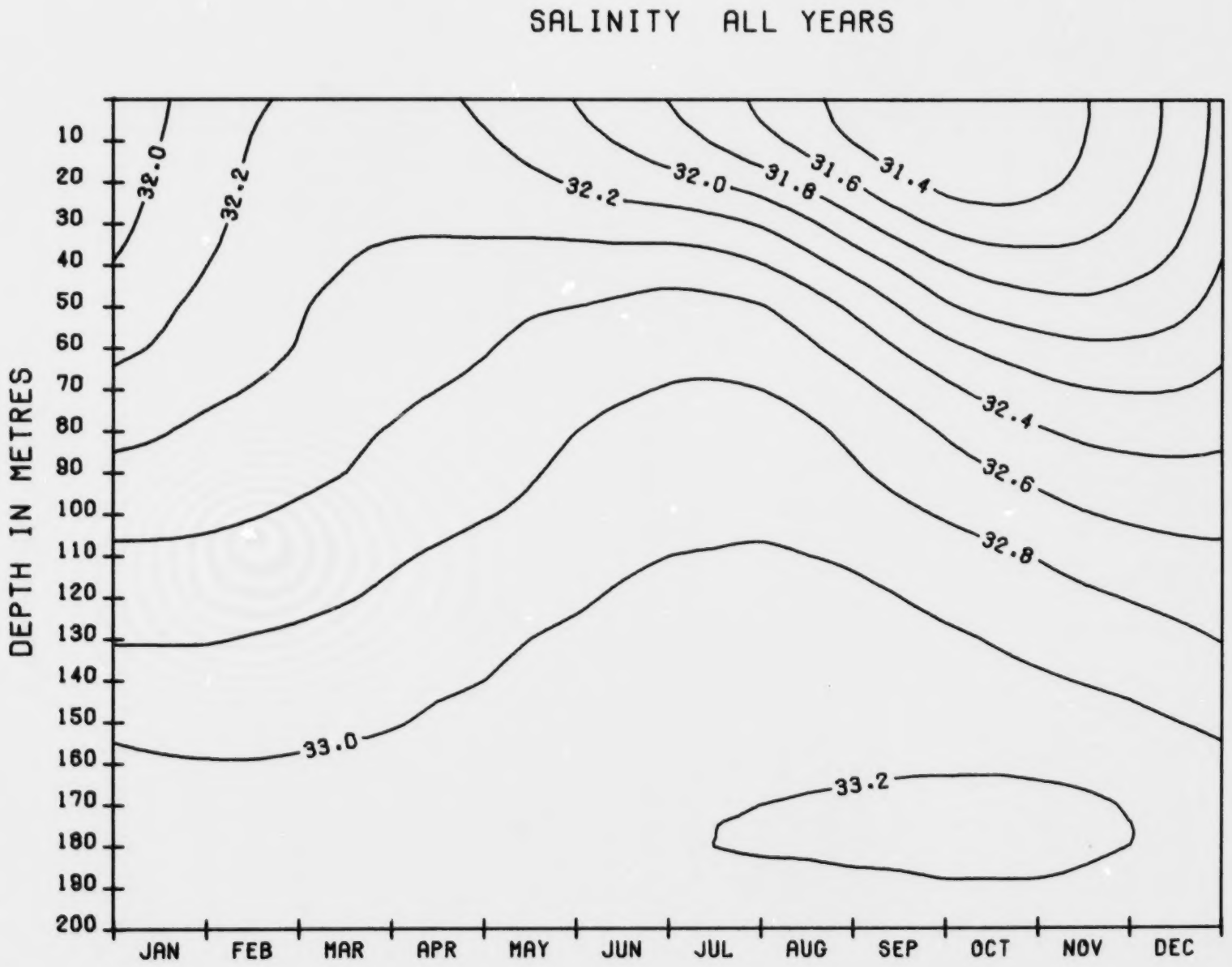
(on microfiche)

APPENDIX C

The average yearly temperature, salinity and σ_t over depth and time for the years 1946 to 1977. Also shown are the gridded data on which the contours were drawn.

TEMPERATURE ALL YEARS




SALINITY ALL YEARS
DEPTH IN METRES
10
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60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
32.0
32.2
32.2
32.0
31.8
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31.4
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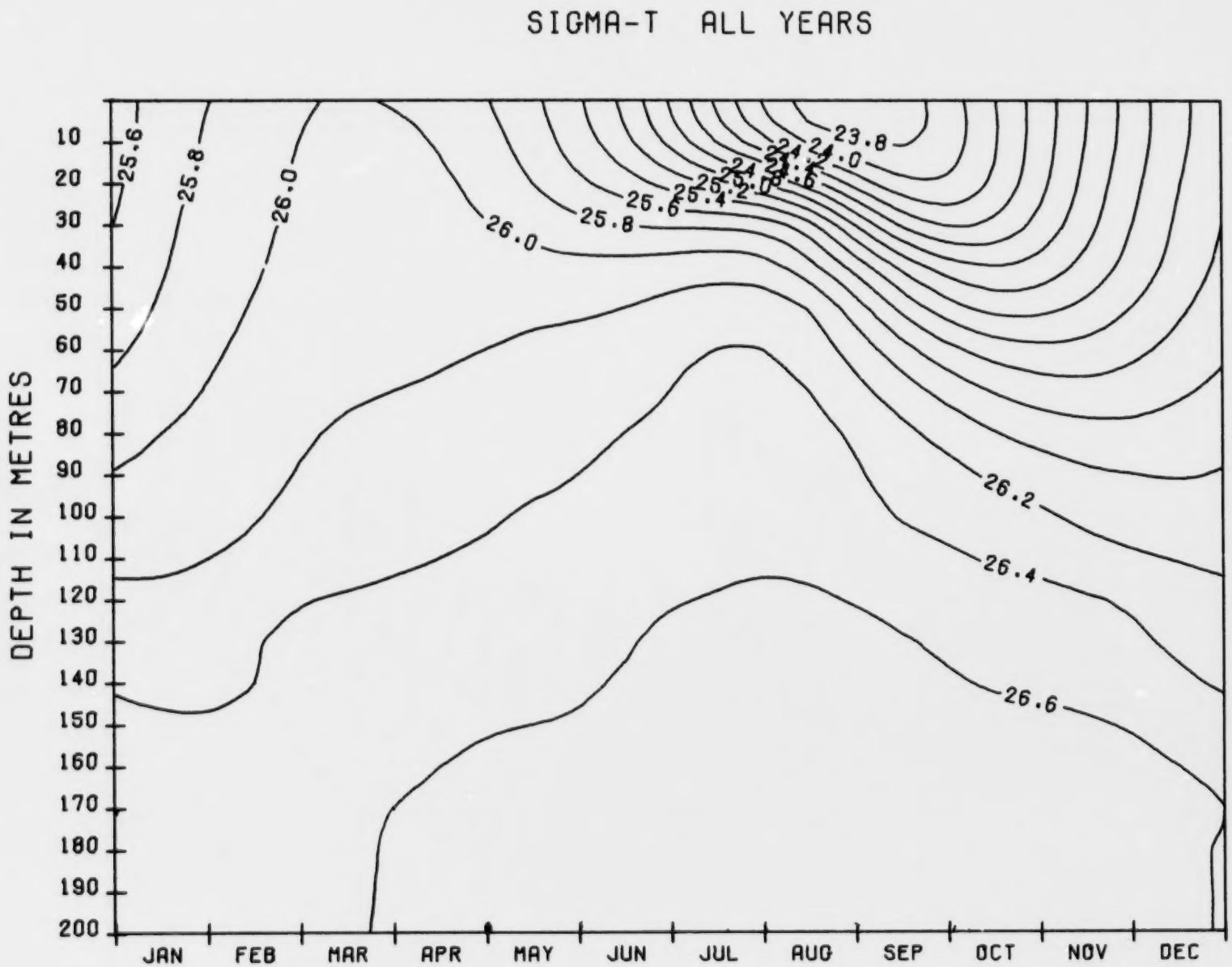
33.0
33.2


SIGMA-T ALL YEARS
DEPTH IN METRES
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26.4
26.6

TEMPERATURE AT STATION 27

	JAN		FEB		MAR		APR		MAY		JUN	
0	1.25	.33	-.33	-.72	-.91	-.92	-.71	-.25	.48	1.73	3.37	5.40
10	1.20	.26	-.42	-.84	-1.06	-1.08	-.90	-.47	.23	1.43	2.98	4.85
20	1.17	.27	-.40	-.82	-1.05	-1.09	-.93	-.55	.03	1.04	2.23	3.54
30	1.14	.27	-.38	-.79	-1.03	-1.09	-.95	-.64	-.21	.51	1.20	1.86
40	1.08	.25	-.37	-.79	-1.03	-1.10	-1.00	-.76	-.44	.02	.31	.50
50	.96	.20	-.40	-.82	-1.07	-1.16	-1.09	-.89	-.66	-.37	-.26	-.27
60	.89	.18	-.40	-.81	-1.07	-1.16	-1.12	-.98	-.84	-.65	-.66	-.76
70	.79	.15	-.40	-.82	-1.08	-1.19	-1.17	-1.08	-.97	-.85	-.88	-.97
80	.67	.12	-.39	-.81	-1.08	-1.21	-1.23	-1.17	-1.10	-1.02	-1.05	-1.09
90	.57	.11	-.36	-.76	-1.04	-1.18	-1.22	-1.21	-1.18	-1.15	-1.18	-1.21
100	.47	.09	-.33	-.72	-1.00	-1.15	-1.22	-1.23	-1.22	-1.21	-1.24	-1.25
110	.34	.07	-.28	-.63	-.89	-1.05	-1.16	-1.19	-1.19	-1.18	-1.20	-1.21
120	.19	.04	-.22	-.51	-.75	-.92	-1.04	-1.09	-1.11	-1.10	-1.12	-1.14
130	.04	-.03	-.22	-.46	-.69	-.86	-.98	-1.04	-1.07	-1.07	-1.09	-1.09
140	-.15	-.15	-.27	-.48	-.69	-.86	-.96	-1.03	-1.06	-1.07	-1.09	-1.10
150	-.34	-.29	-.36	-.55	-.74	-.88	-.98	-1.05	-1.07	-1.07	-1.11	-1.15
160	-.53	-.43	-.44	-.56	-.71	-.83	-.92	-.98	-1.01	-1.01	-1.05	-1.09
170	-.57	-.45	-.41	-.48	-.58	-.68	-.76	-.83	-.87	-.86	-.88	-.92
180	-.38	-.28	-.23	-.26	-.33	-.41	-.49	-.54	-.58	-.58	-.61	-.63
190	-.04	.03	.07	.06	.01	-.04	-.10	-.15	-.19	-.20	-.21	-.23
200	.31	.38	.40	.39	.36	.32	.30	.27	.23	.22	.21	.19

TEMPERATURE AT STATION 27

	JUL		AUG		SEP		OCT		NOV		DEC	
0	7.77	10.12	11.86	12.81	12.55	11.58	10.30	8.72	7.05	5.41	3.83	2.38
10	6.99	9.05	10.55	11.48	11.68	11.31	10.34	8.84	7.11	5.42	3.81	2.36
20	4.95	6.15	6.93	7.87	9.16	10.01	9.82	8.62	6.95	5.29	3.72	2.29
30	2.43	2.73	2.98	3.82	5.79	7.65	8.35	7.82	6.51	5.04	3.56	2.19
40	.55	.50	.62	1.40	3.07	4.93	6.13	6.38	5.73	4.60	3.31	2.06
50	-.42	-.56	-.55	-.11	1.21	2.92	4.24	4.88	4.64	3.94	2.93	1.83
60	-.90	-1.07	-1.09	-.74	.17	1.39	2.49	3.21	3.42	3.14	2.50	1.66
70	-1.06	-1.18	-1.19	-.99	-.43	.35	1.13	1.83	2.30	2.40	2.08	1.46
80	-1.14	-1.20	-1.22	-1.14	-.82	-.33	.23	.81	1.33	1.64	1.59	1.20
90	-1.25	-1.30	-1.30	-1.26	-1.08	-.77	-.43	.02	.50	.91	1.08	.94
100	-1.27	-1.29	-1.28	-1.25	-1.13	-.94	-.70	-.40	-.04	.40	.70	.71
110	-1.22	-1.21	-1.20	-1.17	-1.09	-.97	-.80	-.61	-.34	.01	.30	.42
120	-1.14	-1.12	-1.10	-1.09	-1.05	-.99	-.92	-.80	-.62	-.36	-.08	.14
130	-1.06	-1.00	-.95	-.96	-.99	-.99	-.96	-.91	-.81	-.61	-.36	-.10
140	-1.07	-1.02	-.99	-1.01	-1.05	-1.06	-1.03	-1.02	-.96	-.82	-.59	-.34
150	-1.17	-1.16	-1.18	-1.22	-1.22	-1.18	-1.13	-1.11	-1.08	-.99	-.81	-.54
160	-1.13	-1.17	-1.21	-1.24	-1.23	-1.19	-1.13	-1.10	-1.08	-1.03	-.91	-.73
170	-.96	-1.00	-1.05	-1.09	-1.09	-1.05	-.99	-.96	-.96	-.95	-.89	-.76
180	-.66	-.70	-.74	-.78	-.78	-.76	-.71	-.68	-.67	-.67	-.63	-.54
190	-.25	-.28	-.31	-.33	-.34	-.32	-.30	-.27	-.26	-.26	-.22	-.15
200	.17	.16	.14	.13	.12	.13	.14	.16	.17	.18	.19	.23

SALINITY AT STATION 27

	JAN		FEB		MAR		APR		MAY		JUN	
0	31.87	31.98	32.08	32.17	32.24	32.27	32.26	32.23	32.16	32.08	31.99	31.90
10	31.88	32.00	32.11	32.21	32.28	32.31	32.31	32.28	32.22	32.14	32.06	31.98
20	31.91	32.03	32.14	32.23	32.31	32.35	32.35	32.34	32.30	32.24	32.18	32.12
30	31.95	32.06	32.16	32.25	32.32	32.37	32.38	32.38	32.37	32.36	32.34	32.31
40	32.01	32.10	32.20	32.28	32.35	32.40	32.43	32.45	32.46	32.48	32.49	32.50
50	32.08	32.17	32.25	32.33	32.39	32.44	32.47	32.51	32.53	32.58	32.60	32.63
60	32.16	32.22	32.29	32.35	32.41	32.46	32.51	32.55	32.59	32.65	32.69	32.72
70	32.26	32.31	32.36	32.41	32.46	32.51	32.56	32.60	32.64	32.71	32.75	32.78
80	32.36	32.39	32.44	32.48	32.52	32.57	32.61	32.66	32.70	32.76	32.80	32.84
90	32.44	32.46	32.49	32.52	32.56	32.60	32.65	32.69	32.74	32.79	32.83	32.86
100	32.53	32.54	32.56	32.59	32.63	32.67	32.71	32.75	32.79	32.83	32.88	32.91
110	32.64	32.64	32.65	32.68	32.71	32.74	32.78	32.82	32.86	32.90	32.94	32.97
120	32.71	32.71	32.72	32.73	32.76	32.79	32.83	32.87	32.91	32.95	32.98	33.02
130	32.79	32.79	32.79	32.81	32.83	32.86	32.89	32.93	32.96	33.00	33.03	33.06
140	32.88	32.87	32.87	32.88	32.89	32.92	32.95	32.98	33.00	33.04	33.06	33.09
150	32.96	32.94	32.93	32.93	32.95	32.97	32.99	33.02	33.04	33.06	33.08	33.10
160	33.04	33.02	33.01	33.01	33.02	33.03	33.05	33.07	33.09	33.11	33.12	33.14
170	33.11	33.09	33.08	33.07	33.08	33.08	33.10	33.11	33.13	33.15	33.16	33.18
180	33.13	33.11	33.10	33.10	33.10	33.10	33.11	33.12	33.14	33.15	33.17	33.18
190	33.08	33.09	33.07	33.05	33.06	33.06	33.08	33.10	33.11	33.13	33.14	33.15
200	33.08	33.09	33.07	33.05	33.06	33.06	33.08	33.10	33.11	33.13	33.14	33.15

SALINITY AT STATION 27

	JUL		AUG		SEP		OCT		NOV		DEC	
0	31.79	31.68	31.56	31.44	31.33	31.25	31.21	31.23	31.29	31.39	31.51	31.65
10	31.89	31.78	31.66	31.53	31.39	31.29	31.23	31.24	31.29	31.40	31.52	31.66
20	32.07	31.99	31.90	31.75	31.59	31.44	31.34	31.32	31.36	31.45	31.57	31.70
30	32.30	32.26	32.18	32.04	31.86	31.69	31.55	31.49	31.50	31.55	31.64	31.76
40	32.51	32.48	32.41	32.28	32.13	31.97	31.81	31.72	31.69	31.69	31.75	31.84
50	32.66	32.65	32.61	32.50	32.36	32.20	32.03	31.93	31.87	31.85	31.89	31.95
60	32.74	32.74	32.70	32.63	32.52	32.39	32.26	32.16	32.09	32.04	32.04	32.07
70	32.81	32.82	32.80	32.74	32.66	32.55	32.44	32.34	32.26	32.21	32.19	32.20
80	32.87	32.89	32.88	32.83	32.76	32.68	32.58	32.49	32.42	32.36	32.33	32.33
90	32.89	32.91	32.90	32.87	32.82	32.75	32.68	32.61	32.55	32.49	32.46	32.44
100	32.94	32.96	32.96	32.94	32.89	32.84	32.78	32.72	32.67	32.61	32.57	32.54
110	33.00	33.01	33.02	33.00	32.98	32.94	32.89	32.84	32.79	32.73	32.69	32.66
120	33.05	33.06	33.07	33.06	33.03	33.00	32.95	32.91	32.87	32.83	32.79	32.75
130	33.09	33.12	33.13	33.12	33.10	33.07	33.03	32.99	32.95	32.92	32.88	32.84
140	33.12	33.13	33.14	33.14	33.13	33.11	33.08	33.05	33.02	32.99	32.96	32.92
150	33.11	33.12	33.13	33.13	33.13	33.12	33.12	33.11	33.09	33.07	33.04	33.00
160	33.15	33.15	33.16	33.17	33.17	33.18	33.18	33.18	33.17	33.15	33.12	33.09
170	33.19	33.19	33.20	33.21	33.22	33.23	33.24	33.24	33.23	33.22	33.19	33.15
180	33.19	33.20	33.21	33.21	33.22	33.23	33.24	33.24	33.24	33.22	33.20	33.17
190	33.16	33.17	33.17	33.18	33.18	33.18	33.19	33.19	33.19	33.18	33.16	33.12
200	33.16	33.17	33.17	33.18	33.18	33.18	33.19	33.19	33.19	33.18	33.16	33.12

MEAN SIGMA-T AT STATION 27

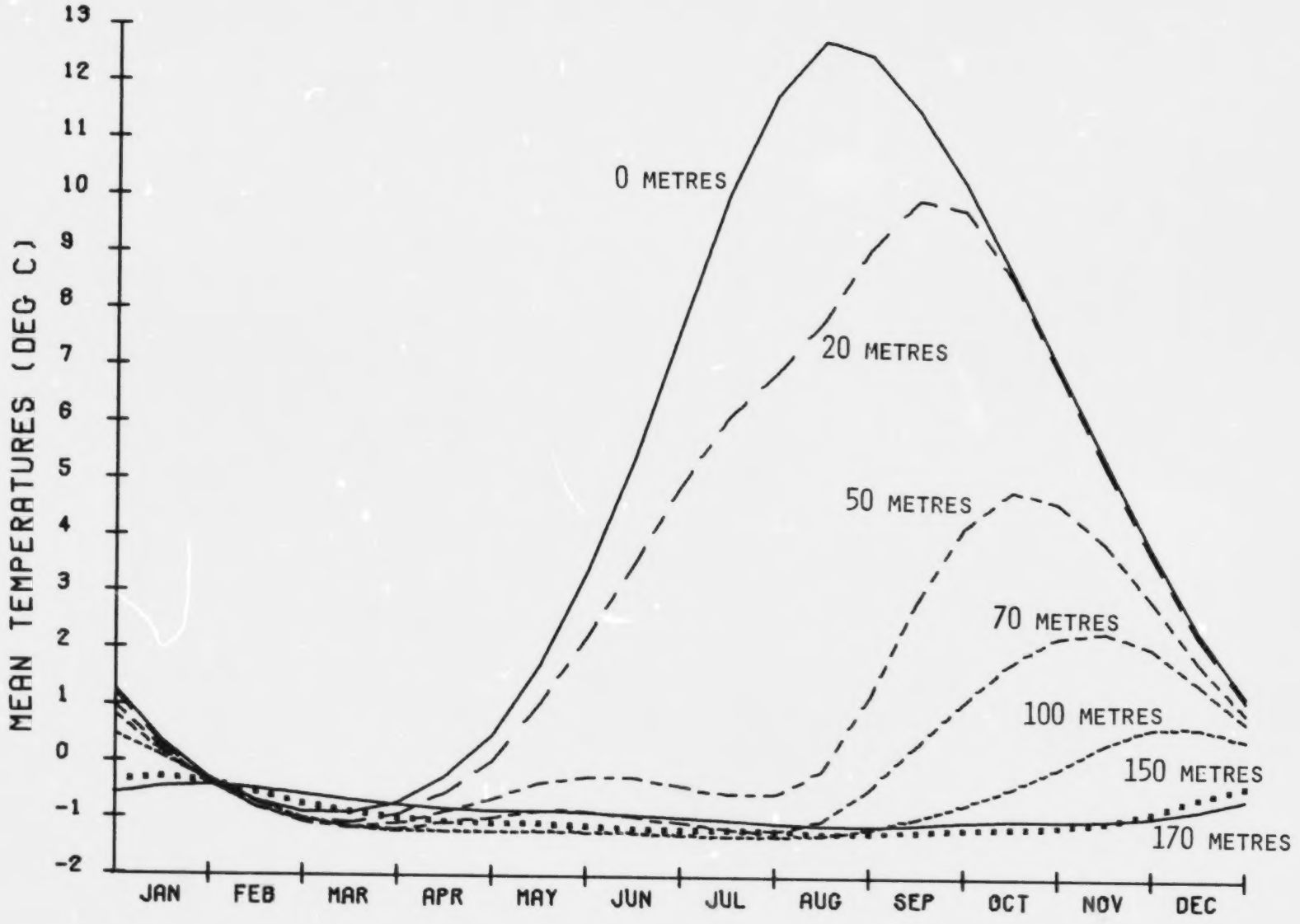
	JAN		FEB		MAR		APR		MAY		JUN	
0	25.51	25.67	25.79	25.90	25.98	26.01	25.99	25.93	25.82	25.66	25.44	25.16
10	25.53	25.68	25.82	25.92	26.00	26.05	26.04	25.99	25.88	25.72	25.51	25.27
20	25.56	25.72	25.84	25.94	26.02	26.07	26.07	26.03	25.95	25.81	25.65	25.50
30	25.60	25.75	25.87	25.96	26.03	26.08	26.08	26.06	26.01	25.94	25.86	25.80
40	25.64	25.78	25.89	25.98	26.05	26.09	26.11	26.10	26.09	26.06	26.05	26.06
50	25.70	25.82	25.93	26.01	26.07	26.12	26.13	26.14	26.15	26.16	26.17	26.20
60	25.77	25.87	25.97	26.04	26.10	26.14	26.16	26.18	26.20	26.23	26.26	26.30
70	25.85	25.93	26.01	26.08	26.14	26.18	26.20	26.22	26.25	26.28	26.32	26.35
80	25.94	26.00	26.06	26.13	26.18	26.22	26.24	26.27	26.30	26.33	26.36	26.40
90	26.01	26.05	26.10	26.15	26.21	26.25	26.28	26.30	26.34	26.37	26.40	26.44
100	26.08	26.10	26.13	26.19	26.25	26.29	26.32	26.35	26.38	26.42	26.44	26.47
110	26.16	26.17	26.20	26.25	26.29	26.33	26.37	26.40	26.43	26.47	26.49	26.52
120	26.25	26.24	26.27	26.33	26.39	26.42	26.44	26.46	26.48	26.51	26.53	26.56
130	26.32	26.30	26.33	26.39	26.44	26.47	26.48	26.50	26.52	26.54	26.57	26.59
140	26.38	26.36	26.37	26.40	26.44	26.47	26.50	26.53	26.55	26.57	26.59	26.61
150	26.46	26.43	26.42	26.45	26.49	26.51	26.54	26.57	26.59	26.60	26.61	26.63
160	26.55	26.52	26.52	26.53	26.55	26.56	26.58	26.60	26.62	26.64	26.65	26.67
170	26.60	26.58	26.57	26.58	26.58	26.59	26.60	26.61	26.63	26.66	26.68	26.70
180	26.59	26.57	26.56	26.56	26.56	26.56	26.57	26.58	26.60	26.62	26.65	26.67
190	26.59	26.57	26.56	26.56	26.56	26.56	26.57	26.58	26.60	26.57	26.60	26.68
200	26.59	26.57	26.56	26.56	26.56	26.56	26.57	26.58	26.60	26.57	26.60	26.68

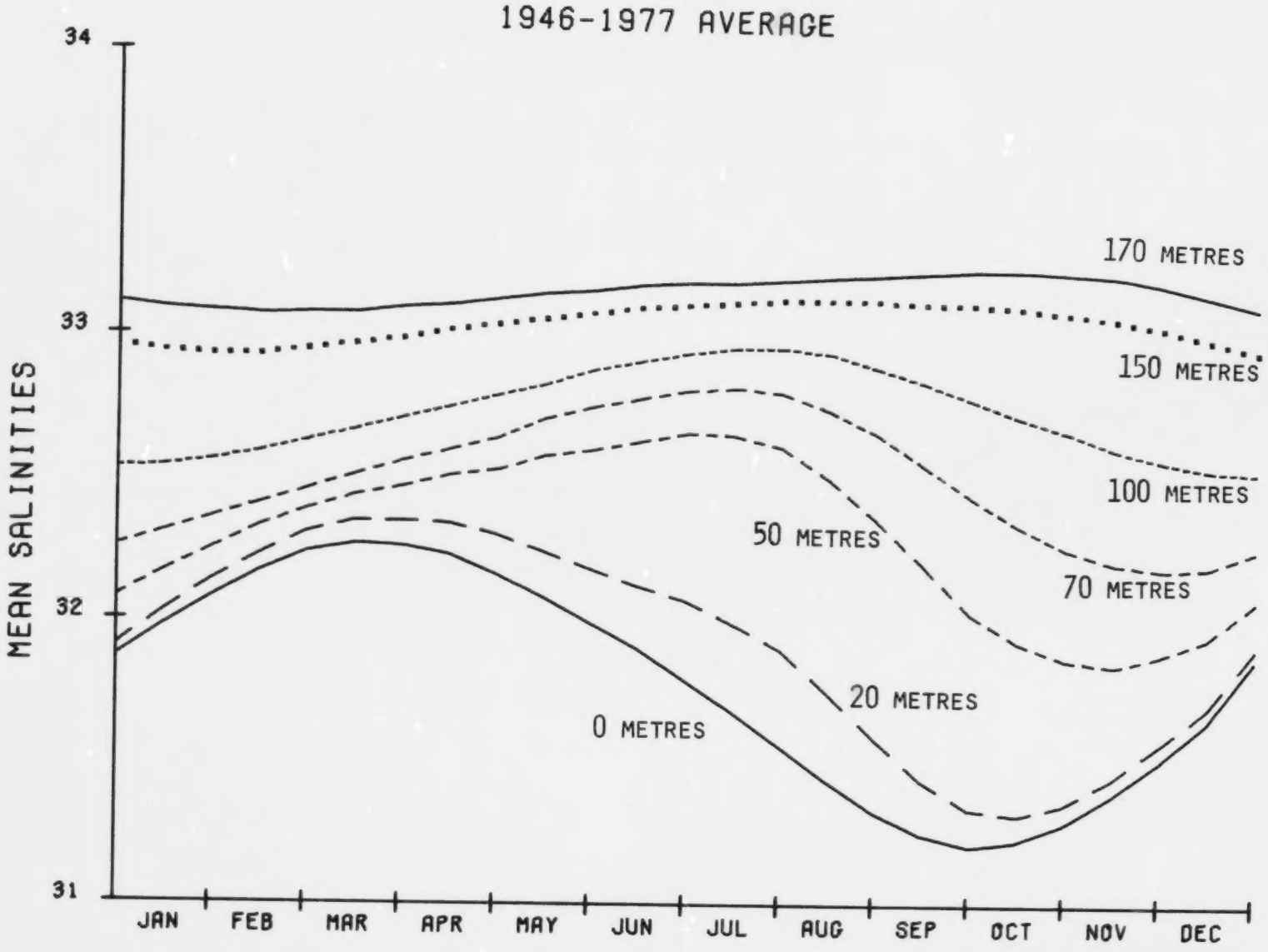
MEAN SIGMA-T AT STATION 27

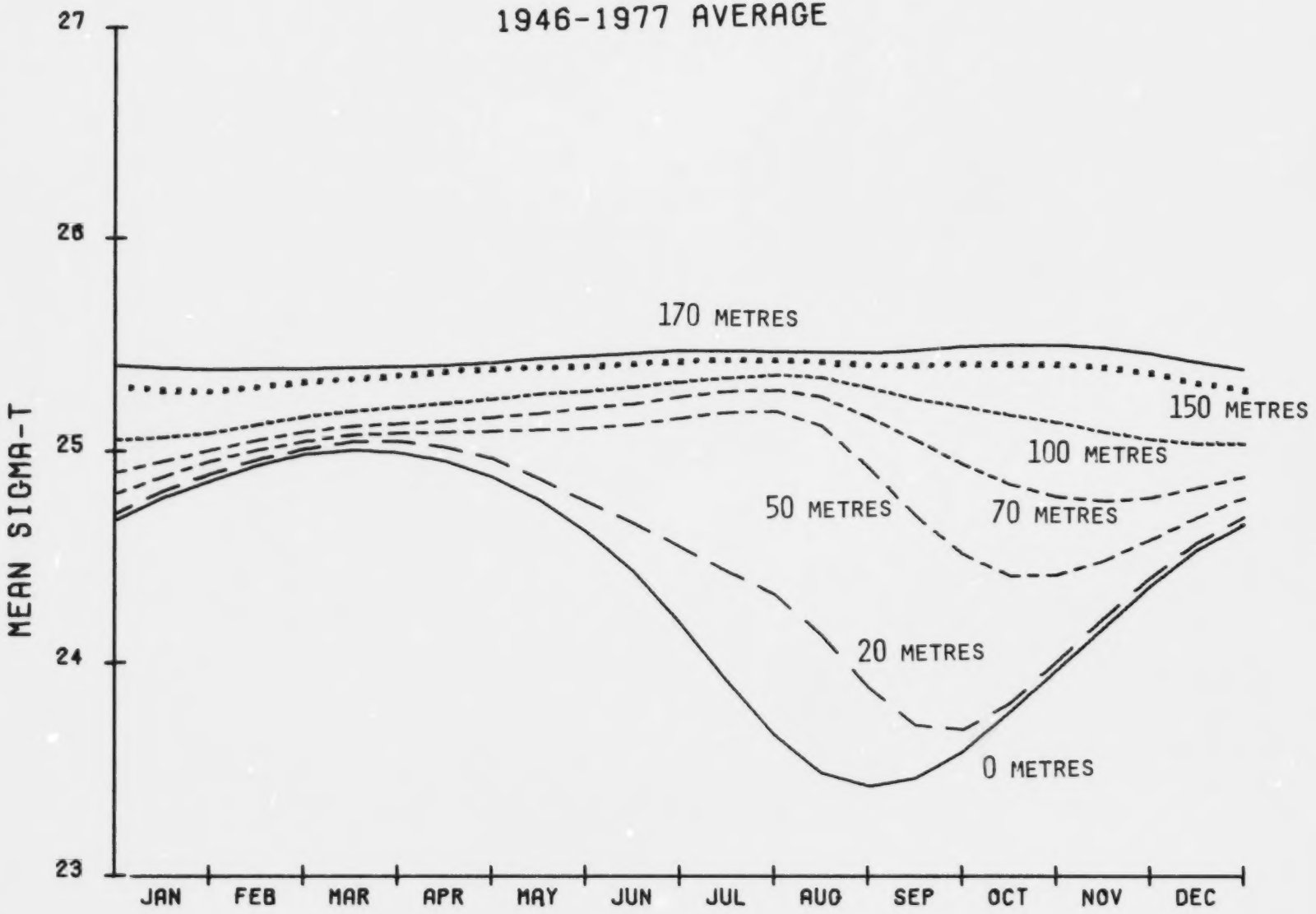
	JUL		AUG		SEP		OCT		NOV		DEC	
0	24.79	24.38	24.00	23.73	23.64	23.70	23.89	24.17	24.47	24.77	25.07	25.33
10	24.96	24.61	24.28	23.99	23.82	23.78	23.90	24.16	24.48	24.79	25.08	25.34
20	25.33	25.16	25.00	24.71	24.34	24.07	24.04	24.23	24.53	24.84	25.13	25.38
30	25.77	25.76	25.70	25.47	25.01	24.59	24.39	24.45	24.66	24.92	25.19	25.42
40	26.09	26.11	26.07	25.87	25.53	25.16	24.90	24.81	24.88	25.06	25.27	25.47
50	26.25	26.29	26.30	26.19	25.90	25.56	25.29	25.14	25.15	25.25	25.40	25.56
60	26.36	26.40	26.40	26.31	26.12	25.88	25.66	25.51	25.45	25.47	25.55	25.66
70	26.40	26.44	26.45	26.40	26.26	26.10	25.93	25.79	25.70	25.67	25.70	25.77
80	26.44	26.48	26.49	26.46	26.37	26.25	26.13	26.01	25.92	25.87	25.86	25.89
90	26.48	26.51	26.51	26.49	26.42	26.33	26.26	26.17	26.10	26.03	26.00	25.99
100	26.51	26.54	26.56	26.54	26.47	26.39	26.34	26.28	26.23	26.16	26.11	26.08
110	26.55	26.57	26.58	26.57	26.53	26.48	26.43	26.38	26.34	26.28	26.23	26.19
120	26.59	26.61	26.63	26.62	26.59	26.55	26.52	26.48	26.46	26.42	26.37	26.30
130	26.63	26.67	26.70	26.69	26.65	26.61	26.58	26.55	26.53	26.49	26.43	26.37
140	26.65	26.69	26.71	26.70	26.67	26.63	26.61	26.59	26.57	26.54	26.49	26.43
150	26.65	26.66	26.66	26.65	26.63	26.63	26.64	26.64	26.64	26.62	26.58	26.51
160	26.68	26.68	26.68	26.67	26.68	26.69	26.71	26.72	26.72	26.70	26.66	26.60
170	26.72	26.72	26.71	26.71	26.71	26.73	26.76	26.77	26.77	26.75	26.71	26.65
180	26.68	26.68	26.68	26.67	26.68	26.69	26.71	26.73	26.73	26.71	26.68	26.63
190	26.68	26.68	26.21	26.09	26.03	26.06	26.15	26.73	26.73	26.71	26.68	26.63
200	26.68	26.68	26.21	26.09	26.03	26.06	26.15	26.73	26.73	26.71	26.68	26.63

APPENDIX D

The average yearly cycle of temperature, salinity and σ_t at selected depths.

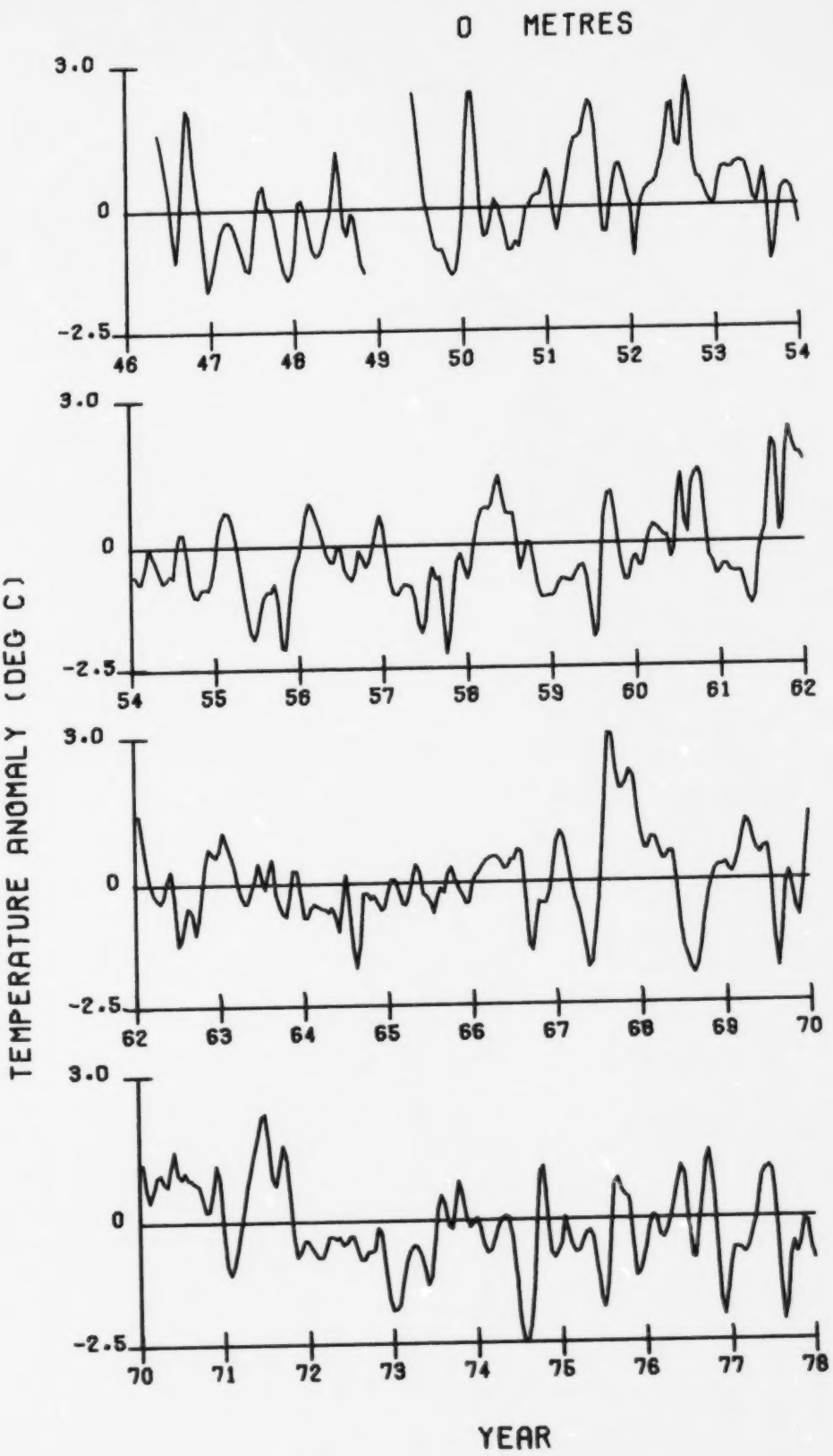

1946-1977 AVERAGE
MEAN TEMPERATURES (DEG C)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
0 METRES
20 METRES
50 METRES
70 METRES
100 METRES
150 METRES
170 METRES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

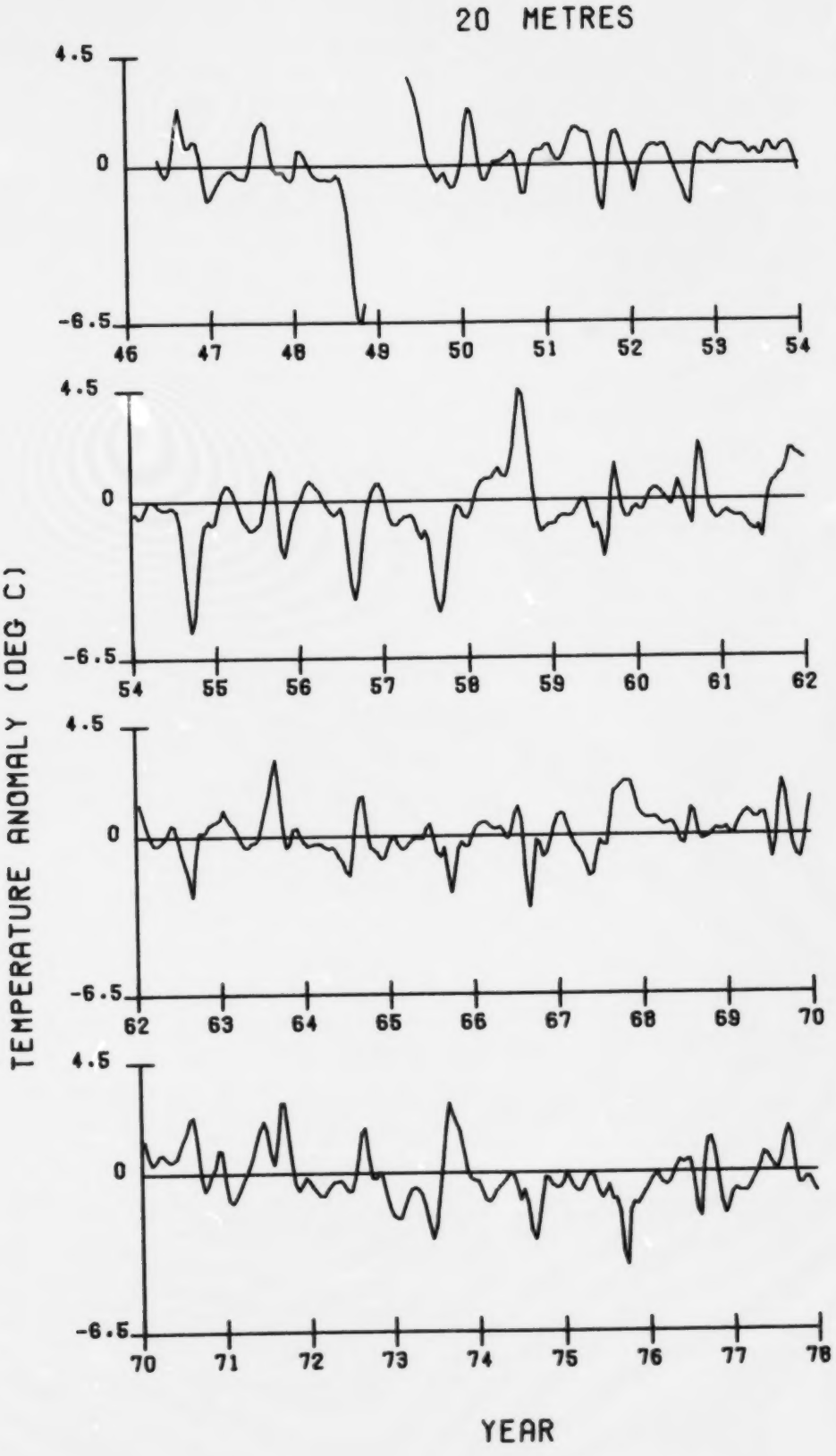

1946-1977 AVERAGE
MEAN SALINITIES
34
33
32
31
170 METRES
150 METRES
100 METRES
70 METRES
50 METRES
20 METRES
0 METRES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

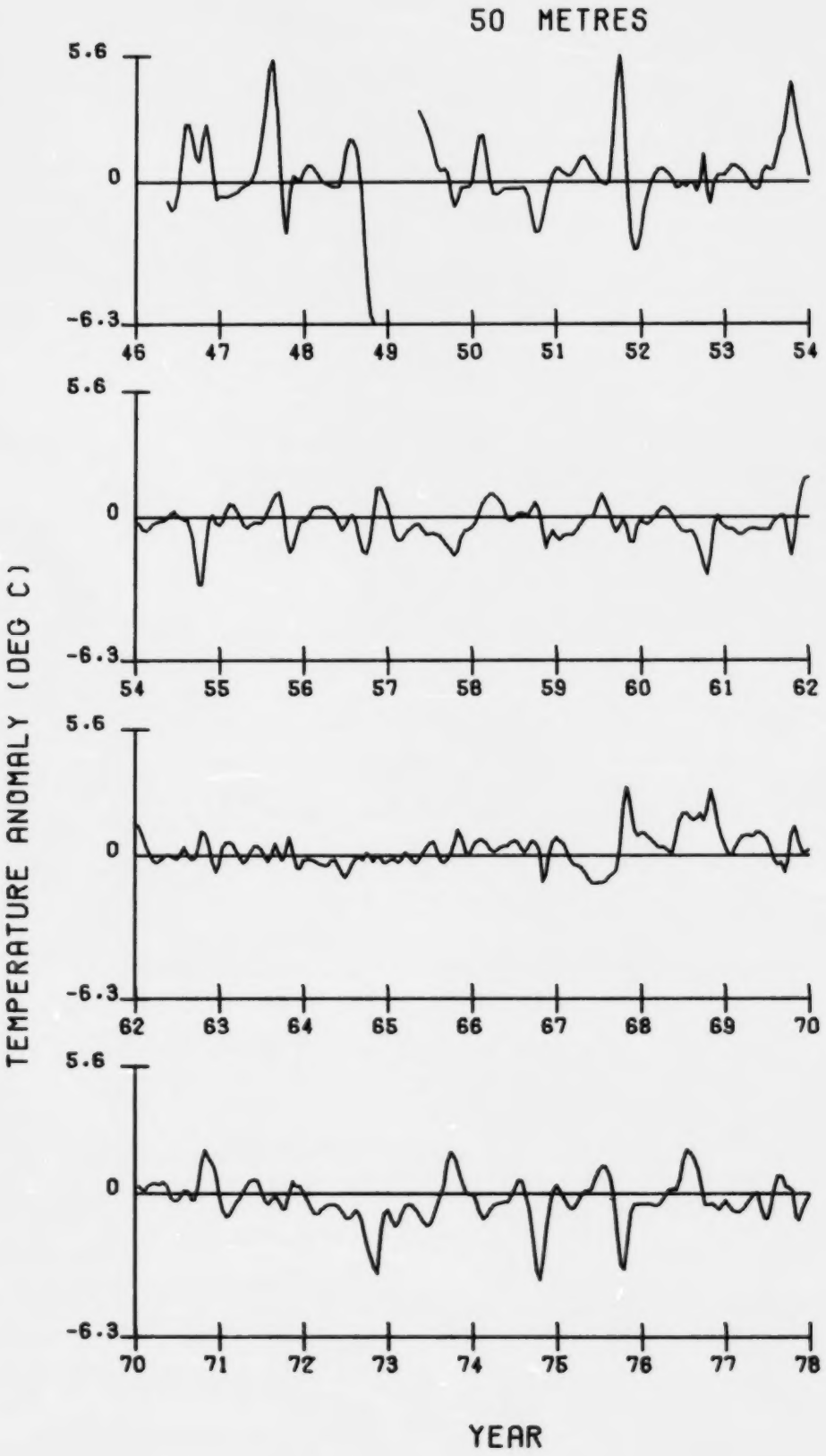

1946-1977 AVERAGE
MEAN SIGMA-T
27
26
25
24
23
170 METRES
150 METRES
100 METRES
70 METRES
50 METRES
20 METRES
0 METRES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

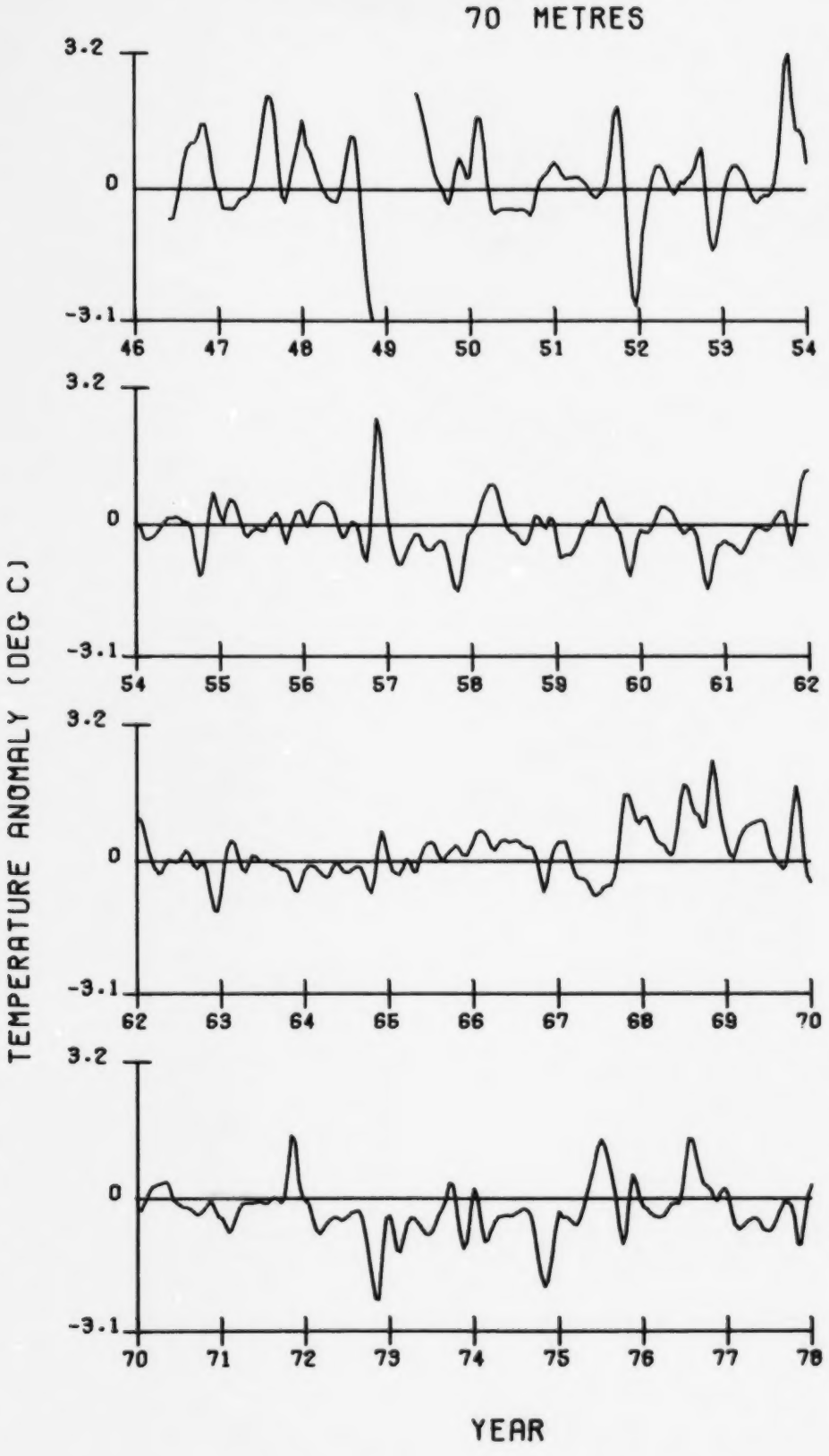
APPENDIX E

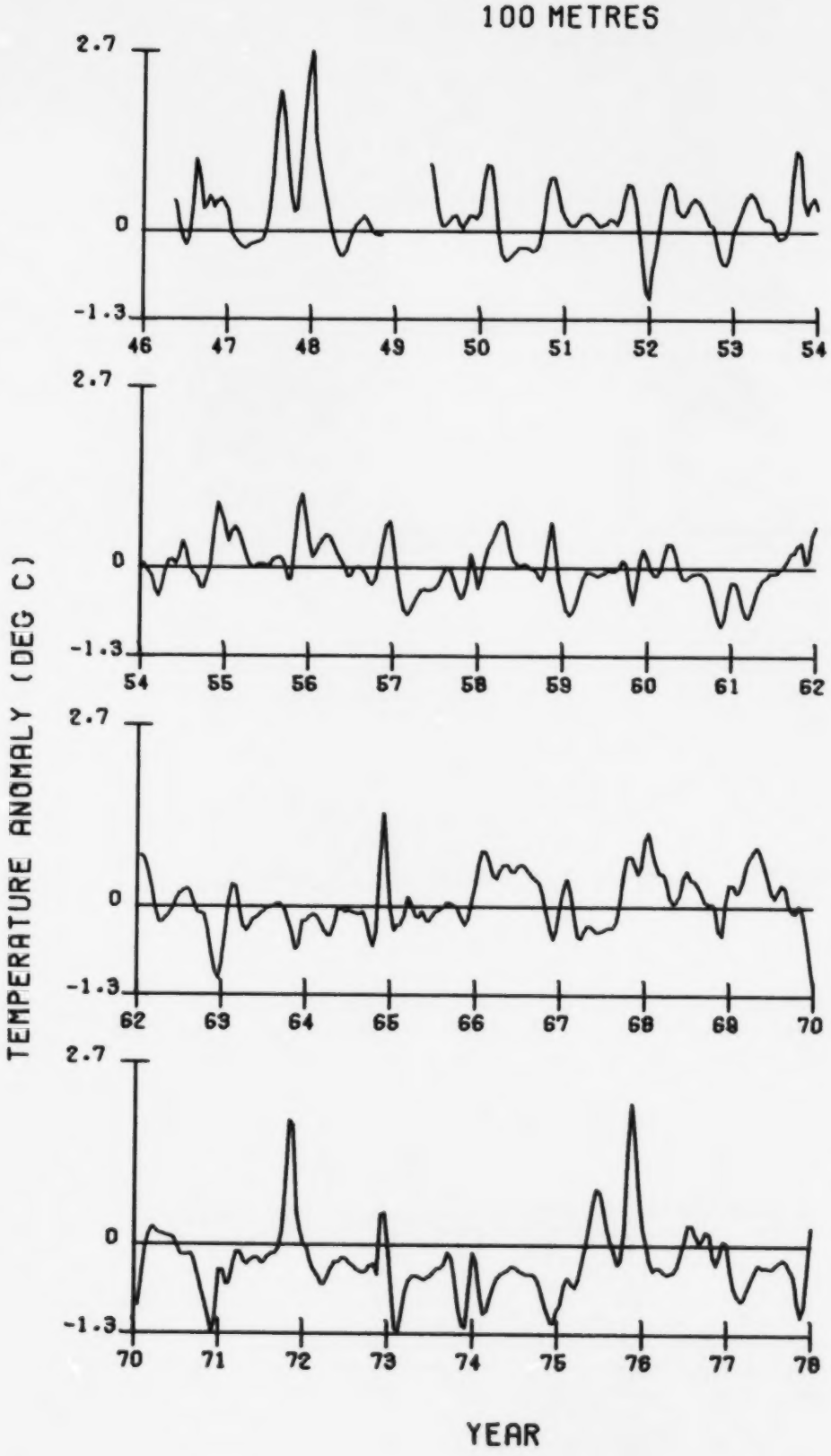
The anomalies of temperature (°C), salinity (‰) and σ_t from 1946 to 1977 at selected depths.

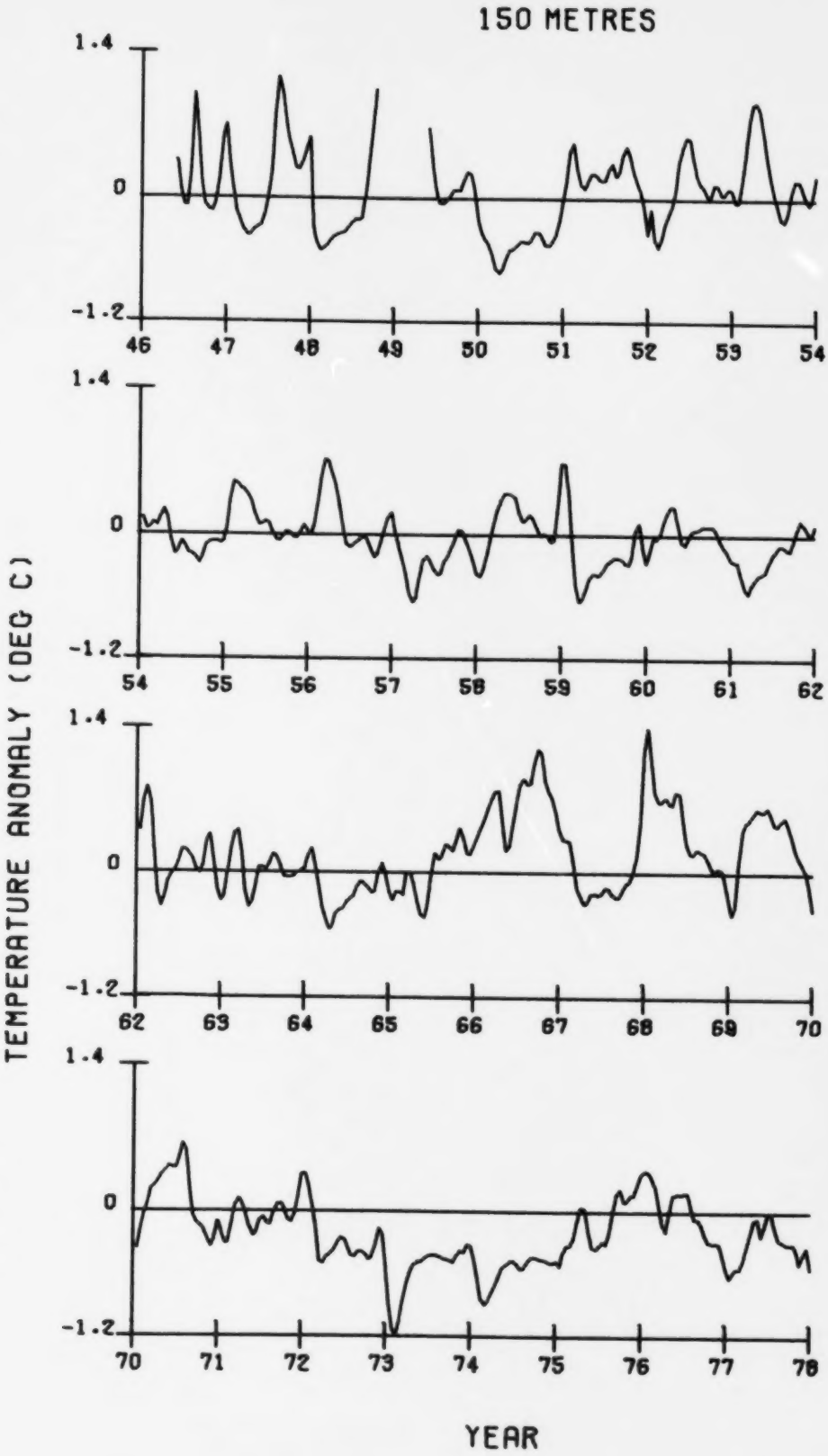

0 METRES
3.0
0
-2.5
46
47
48
49
50
51
52
53
54
3.0
0
-2.5
54
55
56
57
58
59
60
61
62
3.0
0
-2.5
62
63
64
65
66
67
68
69
70
3.0
0
-2.5
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR

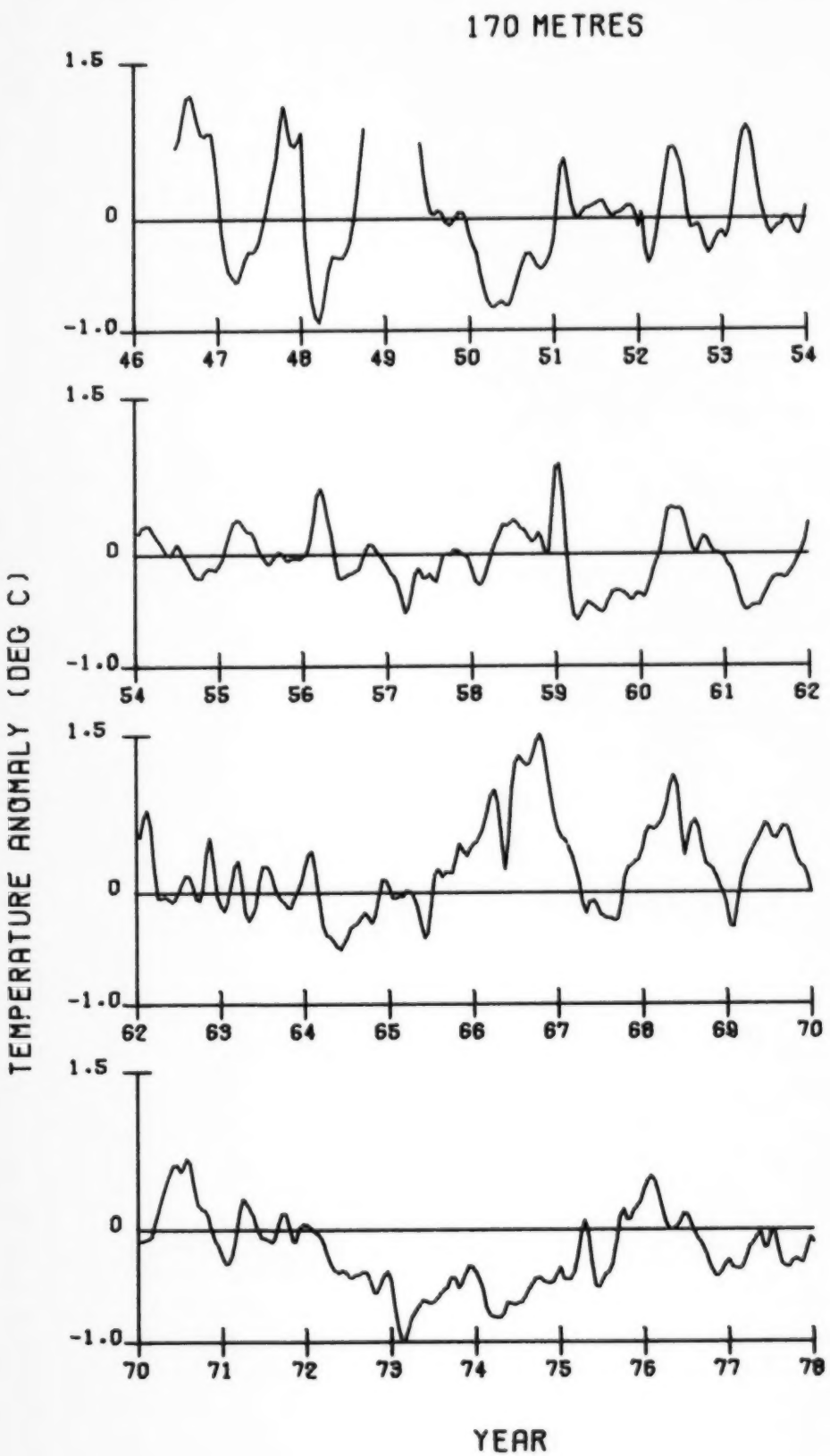

20 METRES
4.5
0
-6.5
46
47
48
49
50
51
52
53
54
4.5
0
-6.5
54
55
56
57
58
59
60
61
62
4.5
0
-6.5
62
63
64
65
66
67
68
69
70
4.5
0
-6.5
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR

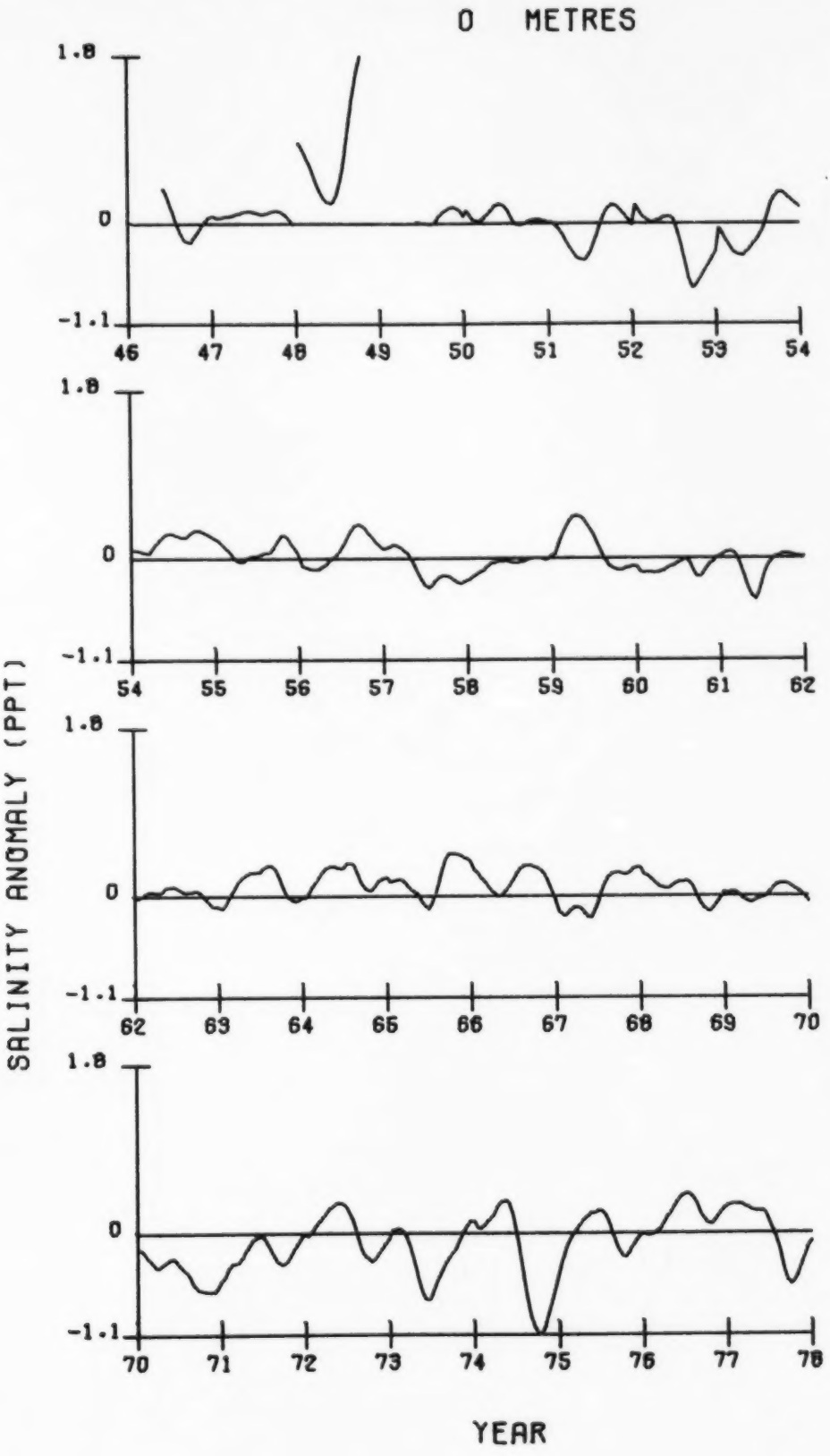

50 METRES
5.6
0
-6.3
46
47
48
49
50
51
52
53
54
5.6
0
-6.3
54
55
56
57
58
59
60
61
62
5.6
0
-6.3
62
63
64
65
66
67
68
69
70
5.6
0
-6.3
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR

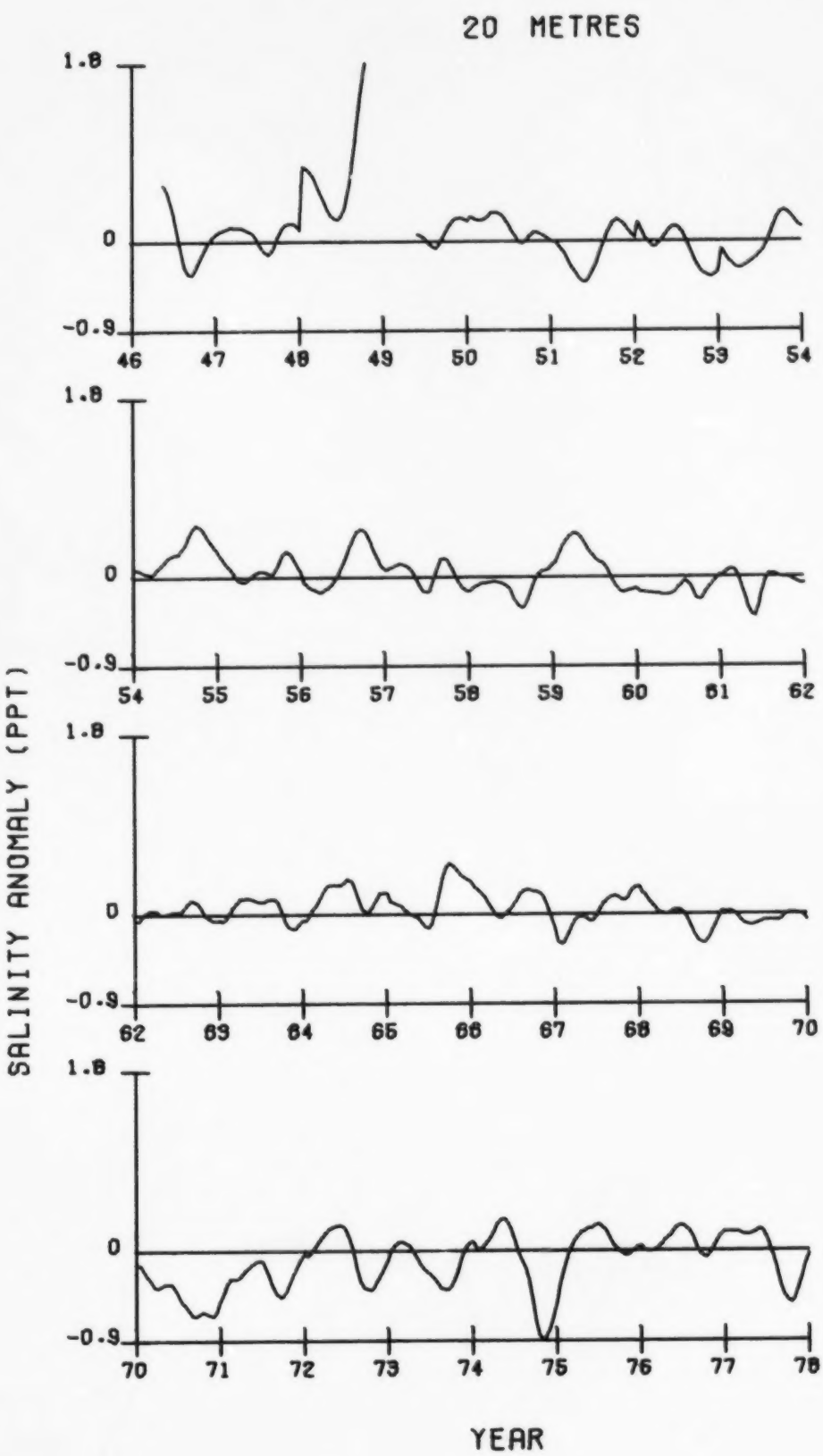

70 METRES
3.2
0
-3.1
46
47
48
49
50
51
52
53
54
3.2
0
-3.1
54
55
56
57
58
59
60
61
62
3.2
0
-3.1
62
63
64
65
66
67
68
69
70
3.2
0
-3.1
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR

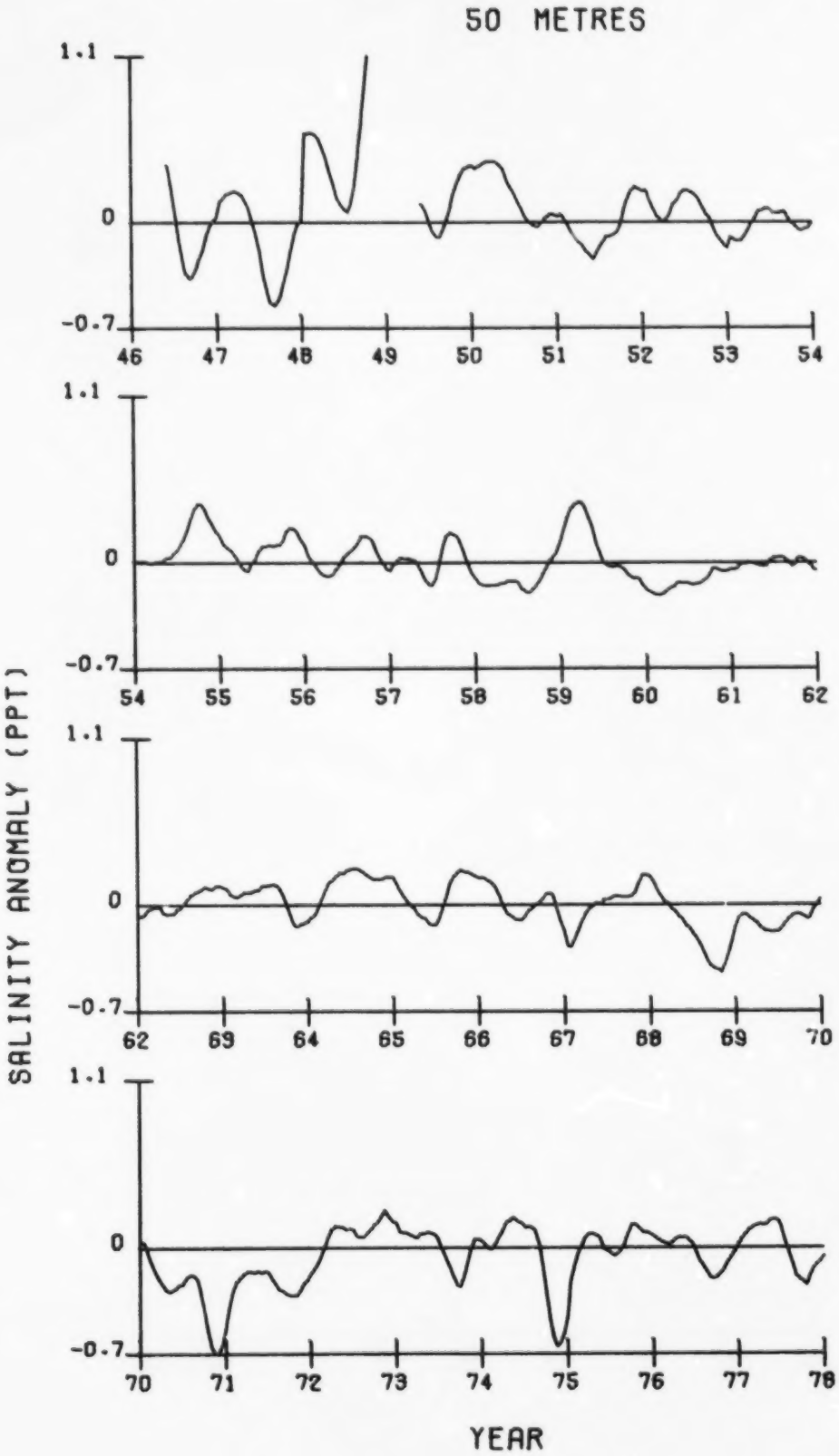

100 METRES
2.7
0
-1.3
46
47
48
49
50
51
52
53
54
2.7
0
-1.3
54
55
56
57
58
59
60
61
62
2.7
0
-1.3
62
63
64
65
66
67
68
69
70
2.7
0
-1.3
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR

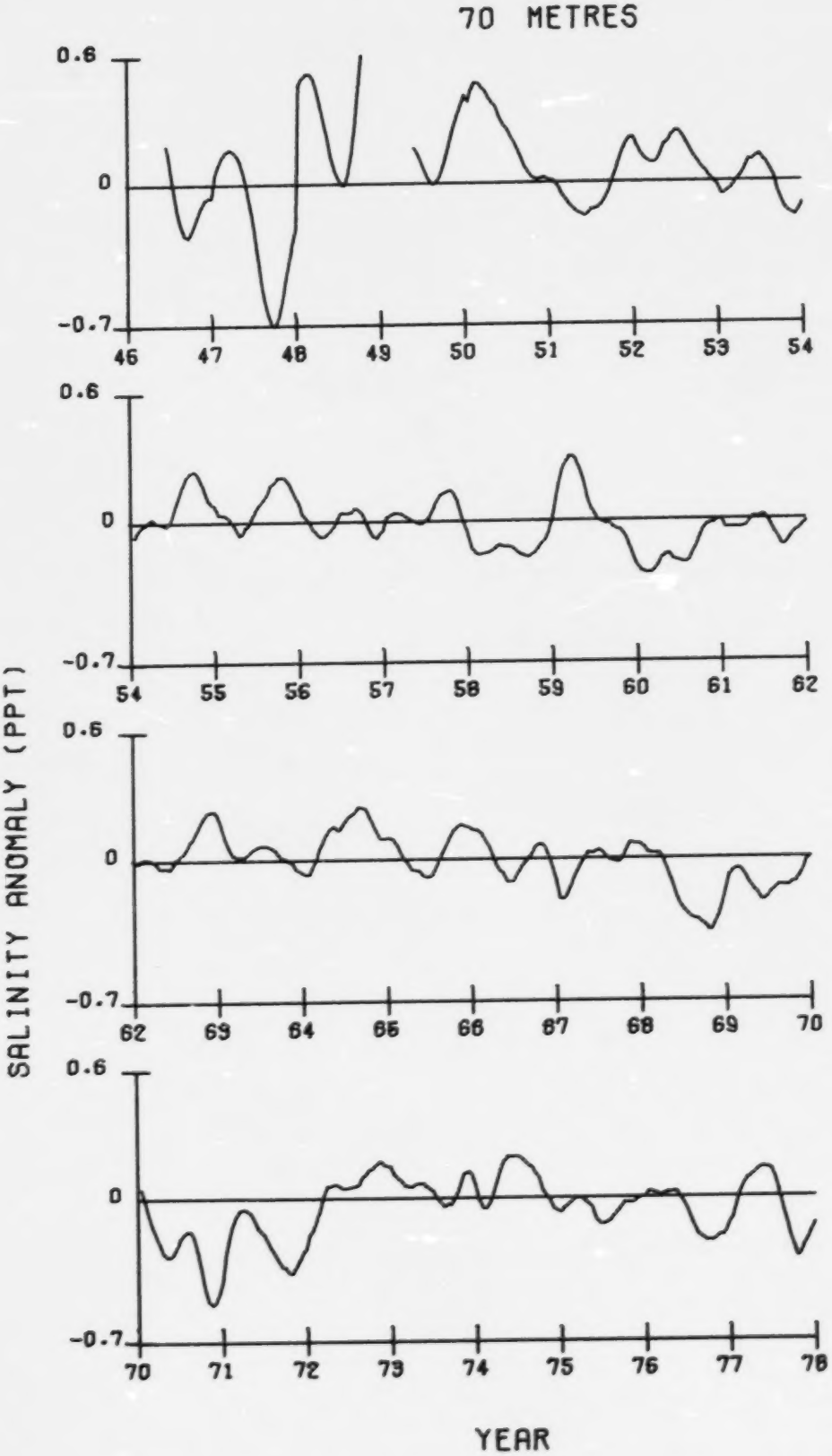

150 METRES
1.4
0
-1.2
46
47
48
49
50
51
52
53
54
1.4
0
-1.2
54
55
56
57
58
59
60
61
62
1.4
0
-1.2
62
63
64
65
66
67
68
69
70
1.4
0
-1.2
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR


170 METRES
1.5
0
-1.0
46
47
48
49
50
51
52
53
54
1.5
0
-1.0
54
55
56
57
58
59
60
61
62
1.5
0
-1.0
62
63
64
65
66
67
68
69
70
1.5
0
-1.0
70
71
72
73
74
75
76
77
78
TEMPERATURE ANOMALY (DEG C)
YEAR


0 METRES
1.8
0
-1.1
46
47
48
49
50
51
52
53
54
1.8
0
-1.1
54
55
56
57
58
59
60
61
62
1.8
0
-1.1
62
63
64
65
66
67
68
69
70
1.8
0
-1.1
70
71
72
73
74
75
76
77
78
SALINITY ANOMALY (PPT)
YEAR


20 METRES
1.8
0
-0.9
46
47
48
49
50
51
52
53
54
1.8
0
-0.9
54
55
56
57
58
59
60
61
62
1.8
0
-0.9
62
63
64
65
66
67
68
69
70
1.8
0
-0.9
70
71
72
73
74
75
76
77
78
SALINITY ANOMALY (PPT)
YEAR


50 METRES
1.1
0
-0.7
46
47
48
49
50
51
52
53
54
1.1
0
-0.7
54
55
56
57
58
59
60
61
62
1.1
0
-0.7
62
63
64
65
66
67
68
69
70
1.1
0
-0.7
70
71
72
73
74
75
76
77
78
SALINITY ANOMALY (PPT)
YEAR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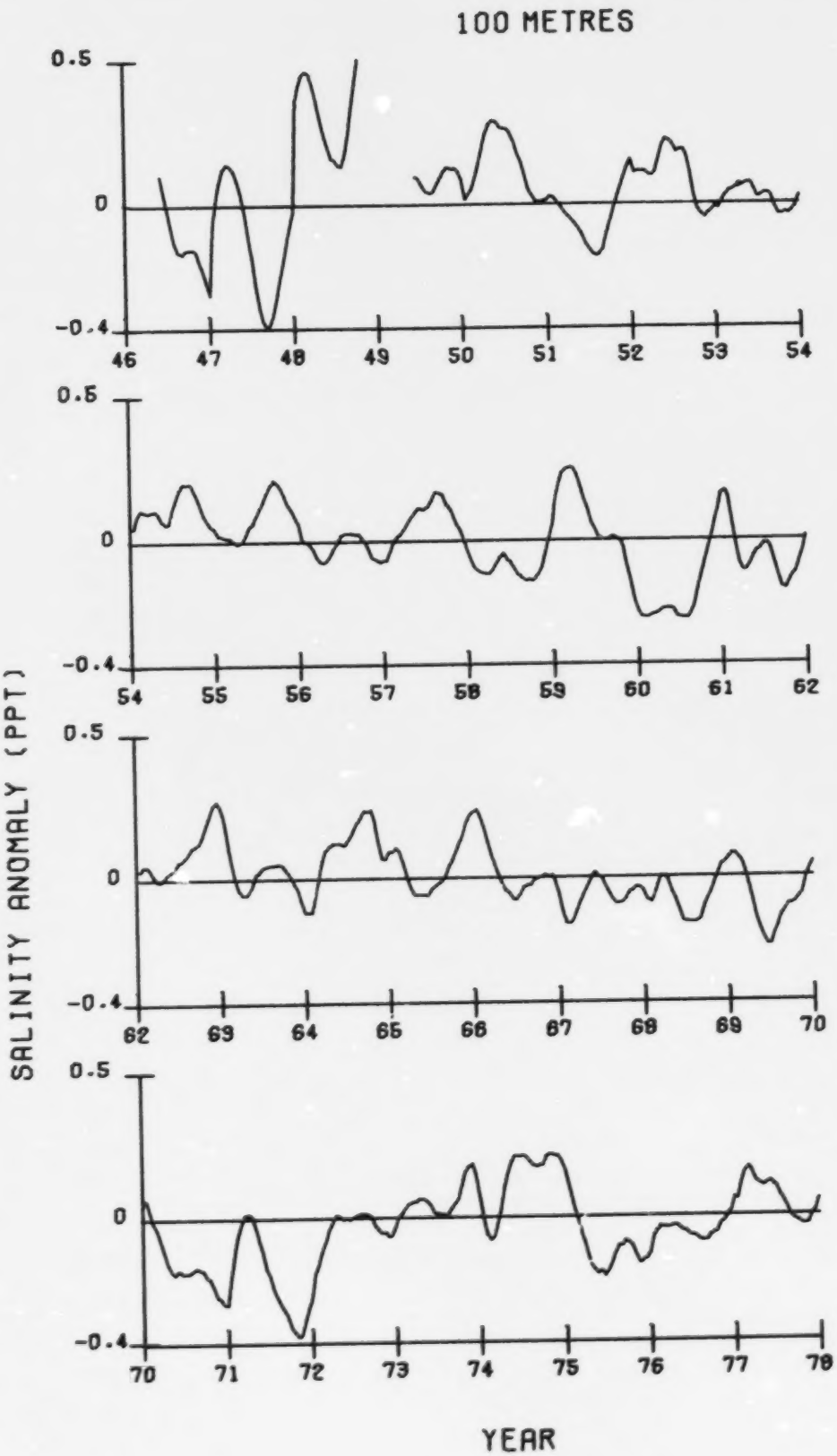
SALINITY ANOMALY (PPT)
YEAR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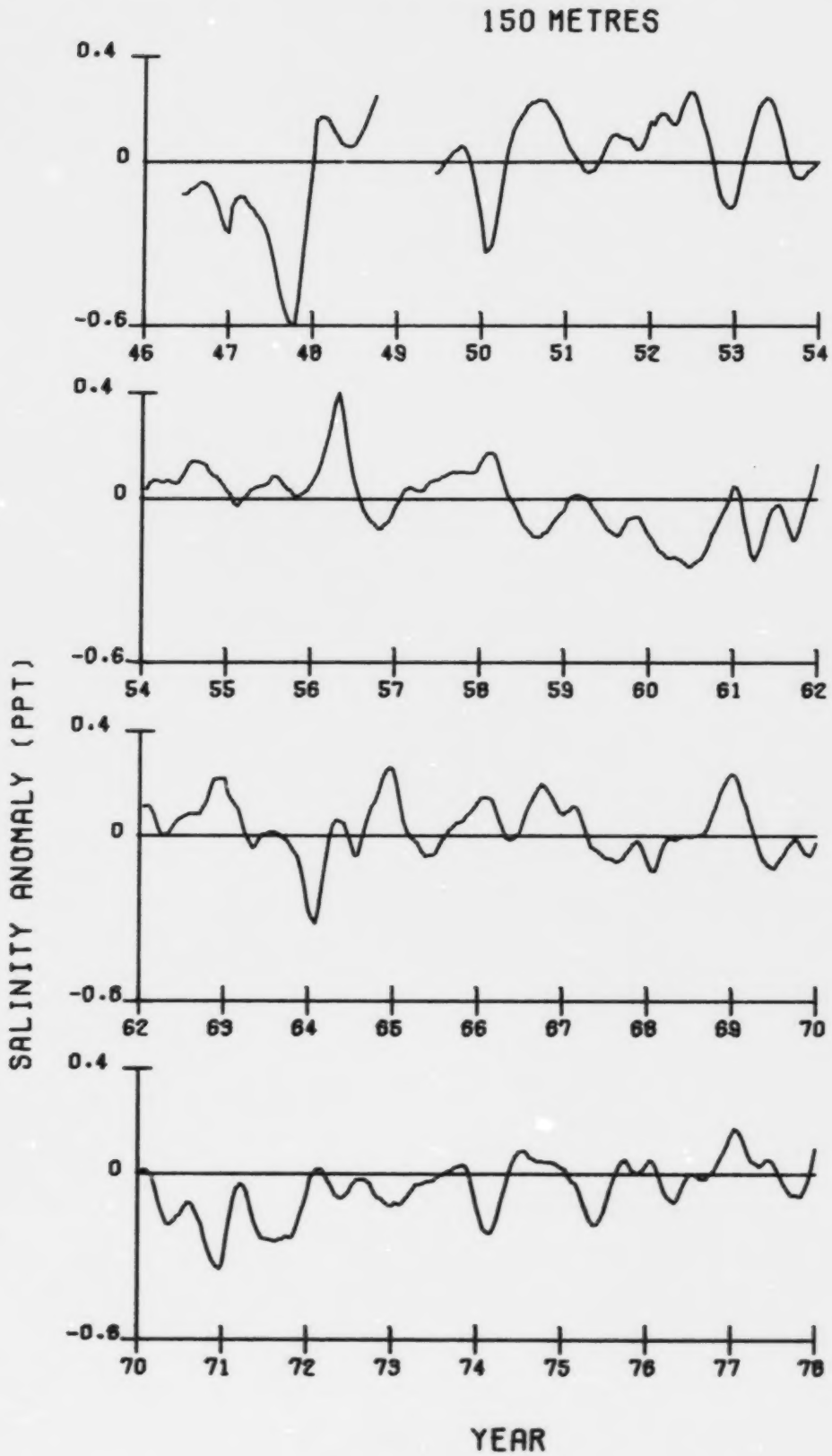
SALINITY ANOMALY (PPT)
YEAR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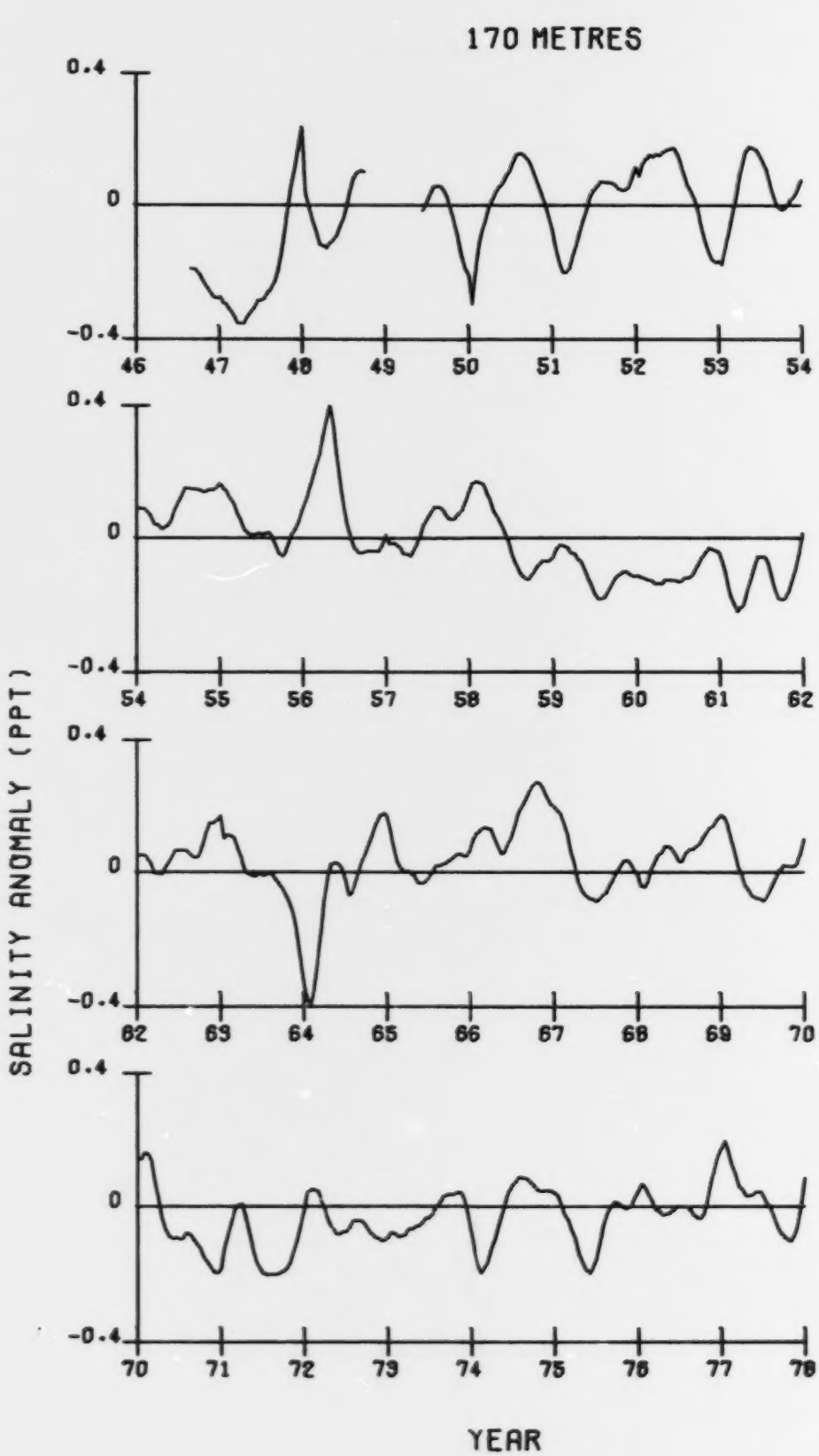
SALINITY ANOMALY (PPT)
YEAR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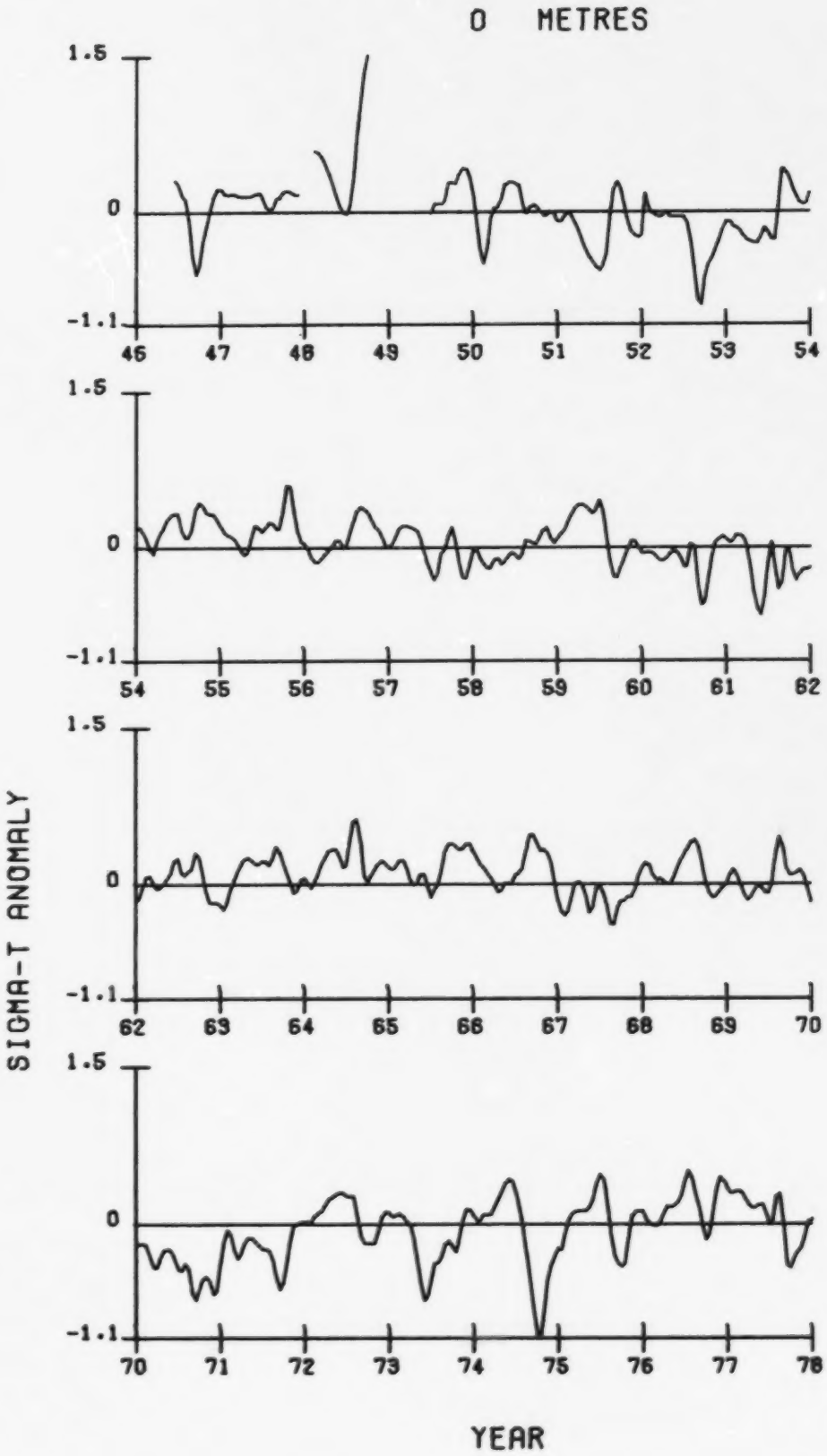
SALINITY ANOMALY (PPT)
YEAR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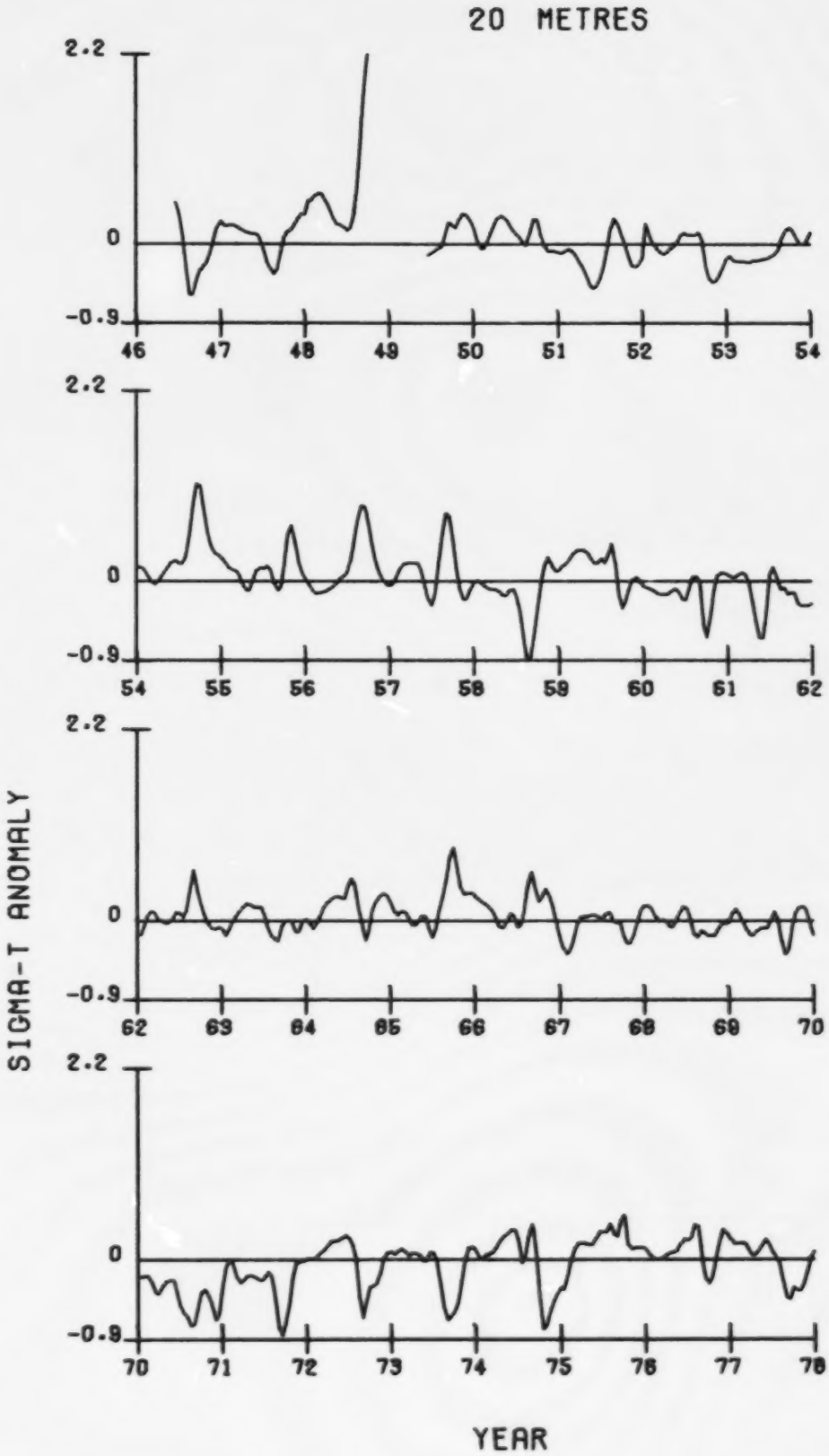
SIGMA-T ANOMALY
YEAR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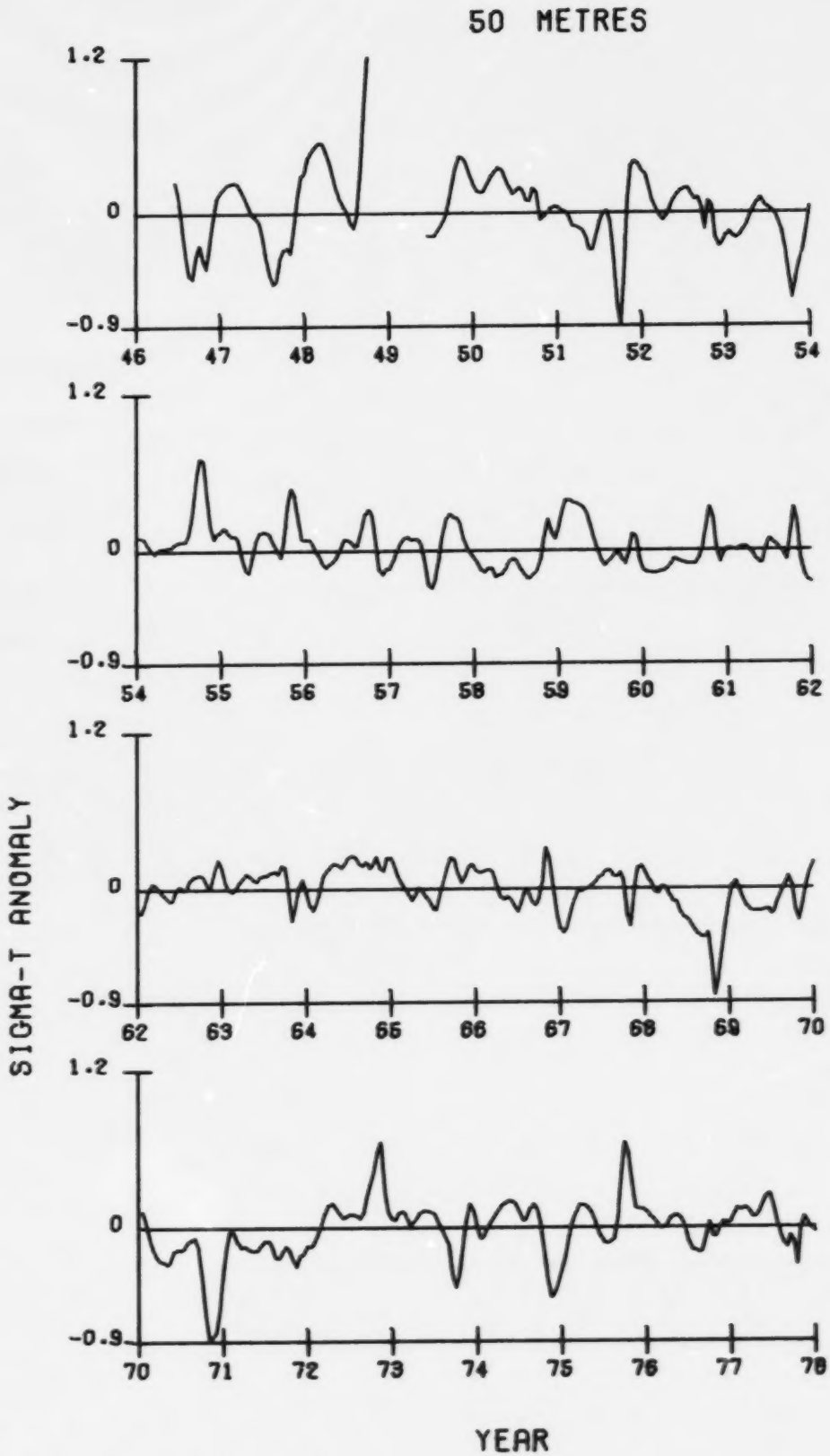
SIGMA-T ANOMALY
YEAR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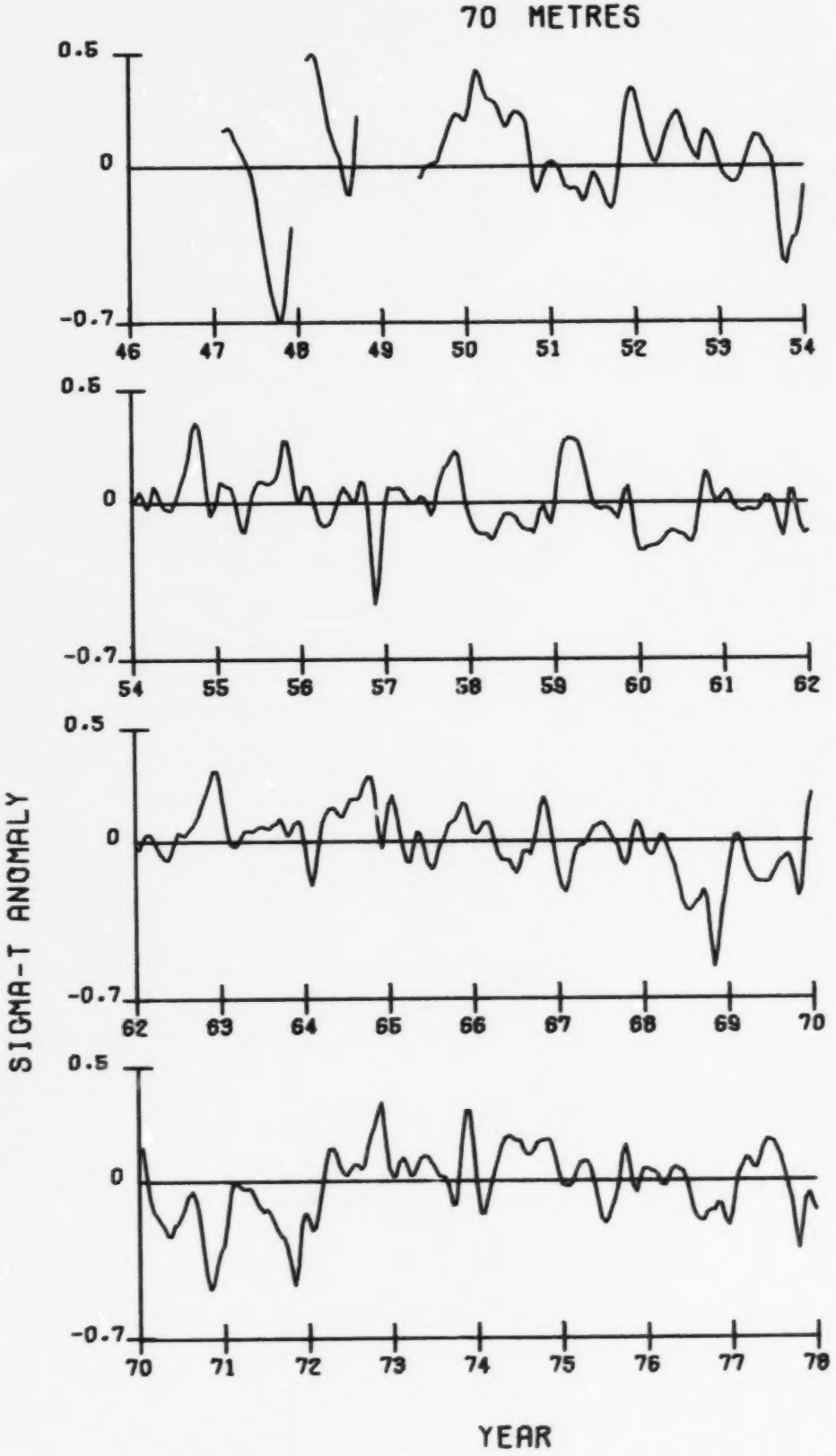
SIGMA-T ANOMALY
YEAR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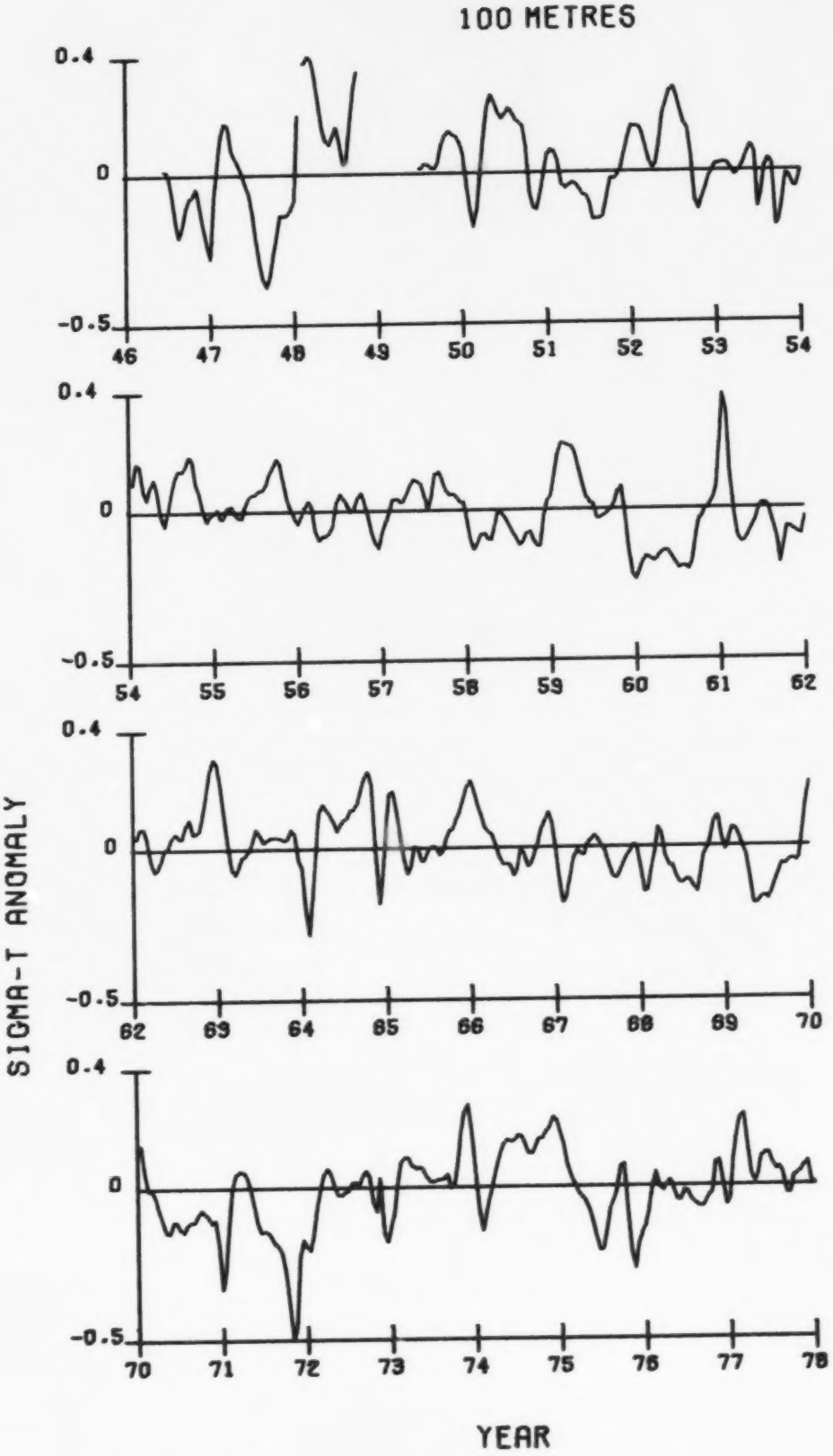
SIGMA-T ANOMALY
YEAR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SIGMA-T ANOMALY
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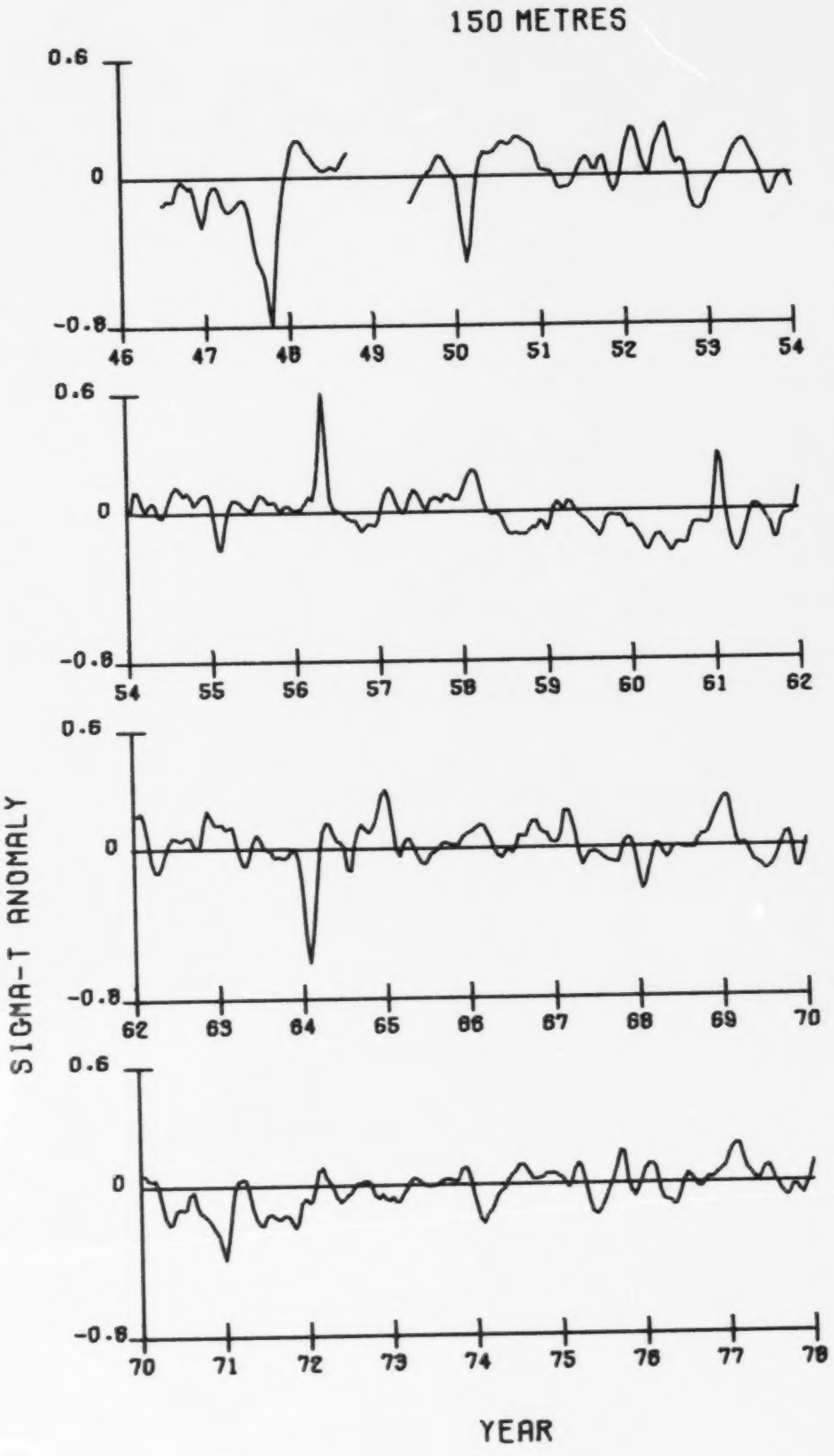
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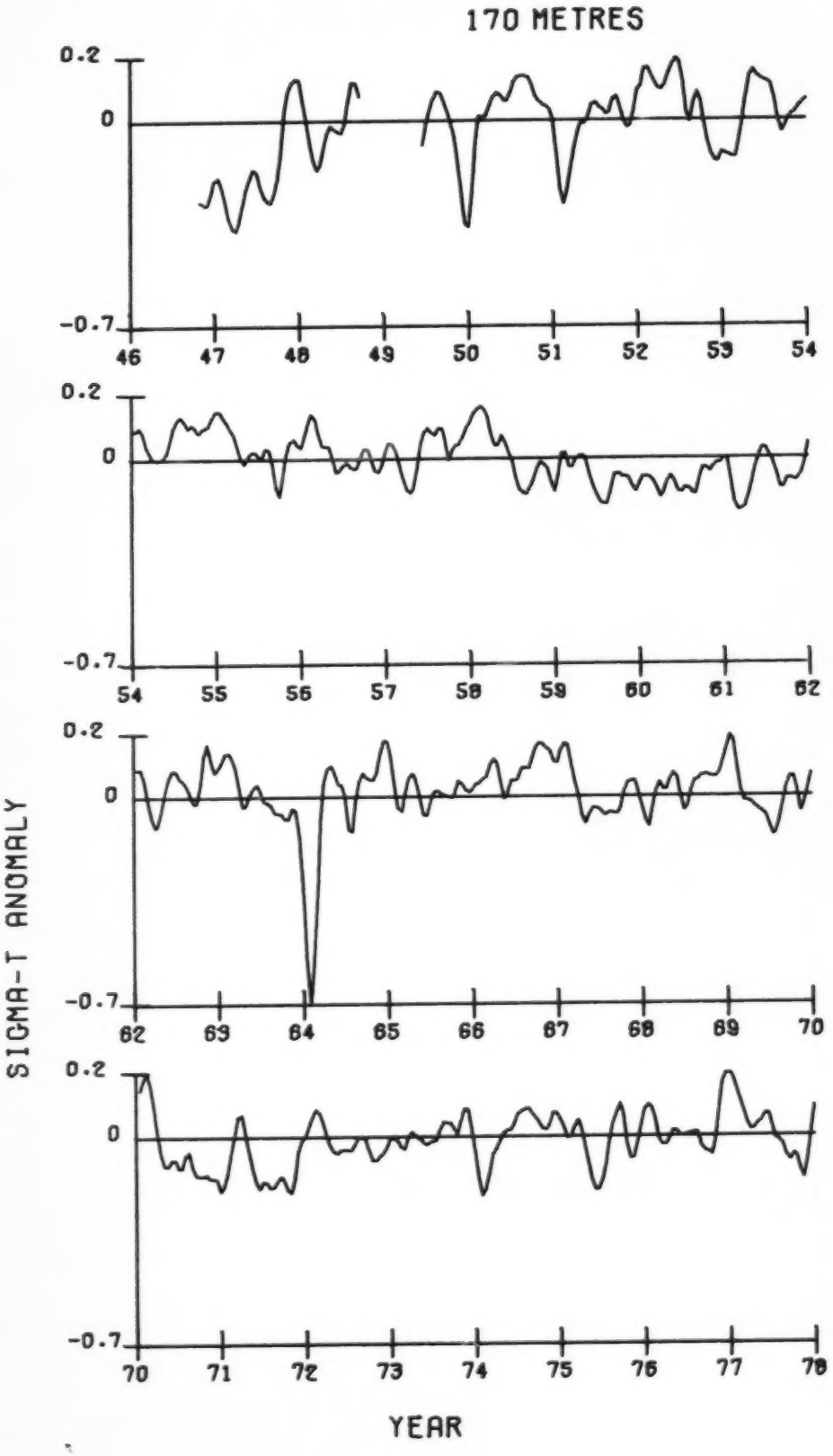
SIGMA-T ANOMALY
YEAR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SIGMA-T ANOMALY
YEAR